THE FOUNDRY

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The Foundry of the Westinghouse Air Brake Co., Wilmerding, Pa.

By W. E. WILKES.

But little more than a quarter of a century has elapsed since the first air brake manufactured under the patents of George Westinghouse was successfully tried on the Pennsylvania railway; yet, in such brief space of time, the manufacture of air brakes for locomotives, passenger and freight cars has assumed mammoth proportions, giving employment to thousands of men, and the Westinghouse brake is known and used in every country of the world where steam locomotion has been called into requisition.

In 1869 patents were issued to George Westinghouse, Jr., on an air brake designed

GENERAL OFFICE BUILDING.

for use on passenger cars. During the same year the Westinghouse Air Brake Co. was organized to carry on the manufacture of brakes under these patents. A suitable location was secured at Twenty-fifth and Liberty streets, Pittsburg, and early in 1870 the manufacture of brakes was commenced in a modest way. The business was carried on here with ever increasing success until 1881, when the growth of the business demanded a larger plant and better facilities for handling large orders. At this

FIG. 1—BIRD'S-EYE VIEW OF PLANT.

date the factory was removed to Robinson street, Allegheny, where it remained until its final removal in 1891 to the present quarters at Wilmerding, fourteen miles east of Pittsburg, on the Pennsylvania railway.

The growth of the air brake industry has been phenomenal, and the strangest part of it is that practically the same company to whom the original patents were granted 28 years ago to-day control, through patents secured in all countries on later improvements, the entire output of air brakes throughout the world. The Wilmerding plant is the parent institution, but in order to meet the demand in foreign countries branch factories have been established at London, Eng., in France and Germany, and at Hamilton, Ont. The latter plant as yet is confined to the finishing and fitting of the brakes, the simpler and heavier castings being made at the Grand Trunk foundry in Hamilton, while the lighter and more complex castings are made in the Wilmerding foundry and shipped to Hamilton to be finished and fitted.

Intended originally for use on passenger cars only (it at first was believed to be unsuited for use on the locomotives), the air brake, through later improvements and the cheapening of the cost of construction, has come into almost universal use on all forms of rolling stock, and a law passed by Congress in 1895 requires that all freight and passenger cars in the United States be

equipped with automatic couplers and air brakes before January 1, 1898. This law is being complied with as fast as the railroads are enabled to adopt these improvements, though the financial stringency of the past few years has held back the installation on many roads, and a further extension of time will undoubtedly be granted. At first only intended as a safety appliance, practice has proven the air brake a factor of economy in the handling of traffic, and this is a greater incentive to their adoption than any compulsory law could ever have been. But the fact of the passage of this law shows the estimation in which the brake is held as a preventive of accidents. Some idea of the magnitude of the business may be had from the fact that in the United States alone there are in actual use nearly one-half million freight and passenger brakes, and of the 36,000 locomotives in this country 31,000 are equipped with air brakes. The growth of the plant and improved facilities for turning out work has more than kept pace with the demands of the business. The first shop had a daily capacity of 20 brakes, whereas the present plant has a capacity of 1,000 completely equipped brakes per day, besides the repairs on the half million brakes now in use, and employs upwards of 2,000 men in the various departments.

To describe the complete plant and follow the work of making and fitting the various parts which constitute the completed brake through all of the various stages of manufacture would occupy more space than is allotted to me, and as the readers of THE FOUNDRY will be more interested in that department of the plant which pertains to their business this article will be confined to a description of the initial stage of manufacture—the iron foundry.

FIG. 2—MAIN FOUNDRY BUILDING.

The first illustration shown is a bird's-eye view of the entire plant which covers an area of over six acres. The building to the right of the picture is the machine shop,

with the carpenter shop in the rear; in the center foreground is the office of the superintendent and immediately behind this is a large two-story warehouse and the pattern shop. The building in the background to the left is used as a brass foundry and boiler shop; the building next the railway is the iron foundry, and between the two larger buildings is seen the front and part of the skylight of the new addition to the foundry. The general offices of the company are also located at Wilmerding, about four squares from the works. The edifice is a handsome stone structure containing, in addition to the general offices, a dining room, gymnasium, and bath rooms for the benefit of the office force, and a well stocked library, under the auspices of the Y. M. C. A., for the benefit of the citizens of Wilmerding.

While the residents of Wilmerding are chiefly employes of the Westinghouse company, unlike other corporation towns, employment with the company does not necessarily mean a residence in the town founded by the company, and hundreds of the employes live in Pittsburg and Allegheny or their immediate suburbs, traveling from thirty to forty miles daily to and from their work. The town is, of course, modern in its construction, having electric lights, water supply, paved streets, and two lines of electric cars, with many other conveniences which are rarely found outside of the large cities.

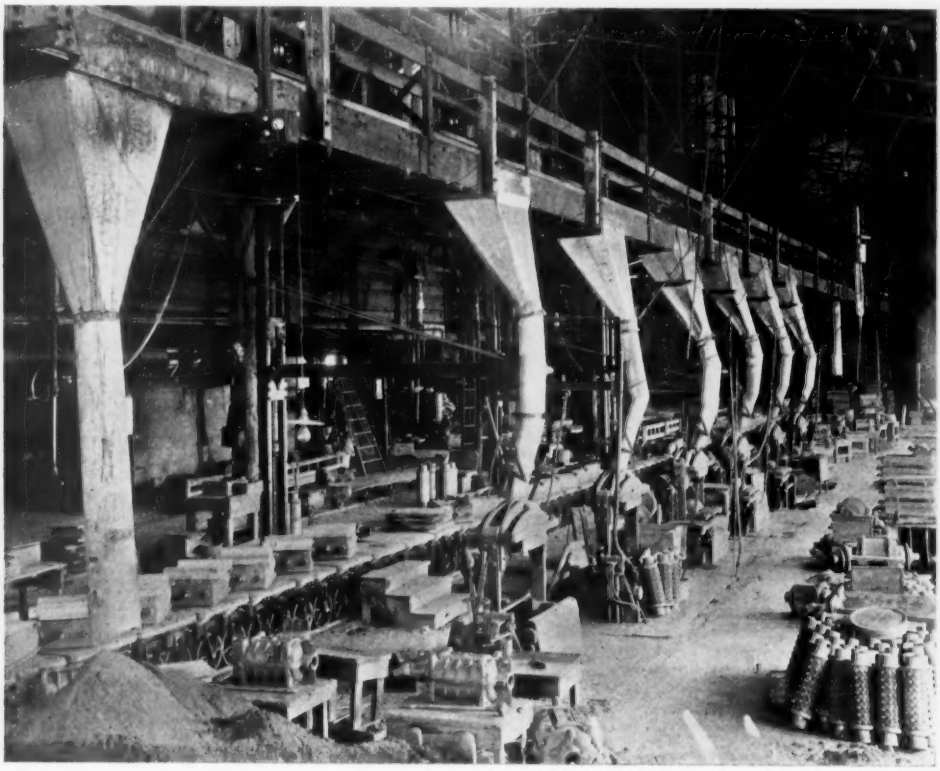


FIG. 3—HEAVY MOLDING MACHINES.

The illustration, figure 2, is an exterior view of the iron foundry, showing merely a corner of the roof structure of the new addition. The foundry covers an area of 200x300 feet, and is well lighted by large side windows and numerous skylights which are plainly seen in the illustration. The new foundry is roofed with corrugated glass, which admits a plentiful supply of light without the glaring effect of direct sun rays. For dark mornings and night work the

foundry is well equipped with both arc and incandescent lamps, so that the question of light, so essential in the foundry, is well taken care of here. The reader may judge of the distribution of the light from the fact that all of the illustrations shown were made from daylight photographs.

In figure 3 is shown the heavy molding machines used in molding brake cylinders and reservoirs. In the construction of these machines there are no peculiar points of interest, they being like the molding machines in common use for heavy work, differing from the common type only in a few minor details. These machines are operated in part by air and in part by hydraulic pressure, with the exception of the two machines in the near foreground which have recently been reconstructed on a new model and are operated wholly by compressed air. The chief interest attaches not to the machines themselves, but to the method of serving the machines, and the facility with which the molds are handled, cored, poured, shaken out and the sand retempered and returned to the machines for immediate use. The machines are worked in pairs, one on the cope part of the mold, the other on the drag. In the work of making the molds three men are required to operate each machine. The flask is lifted from the conveyer by hand and set in position on the machine, and a little weak facing sand is placed on the pattern around the gates. By pulling a lever the chute leading from the sand conveyer over head is opened and the flask partly filled with sand; the joint is then firmly rammed by hand with pene rammers, an iron frame is adjusted on the top edge, the flask filled with sand and leveled off to the top of the gauge, two strokes of the piston, the pattern is withdrawn through the stripping plate, and the mold is ready for the finishers and core setters. As fast as the molds are

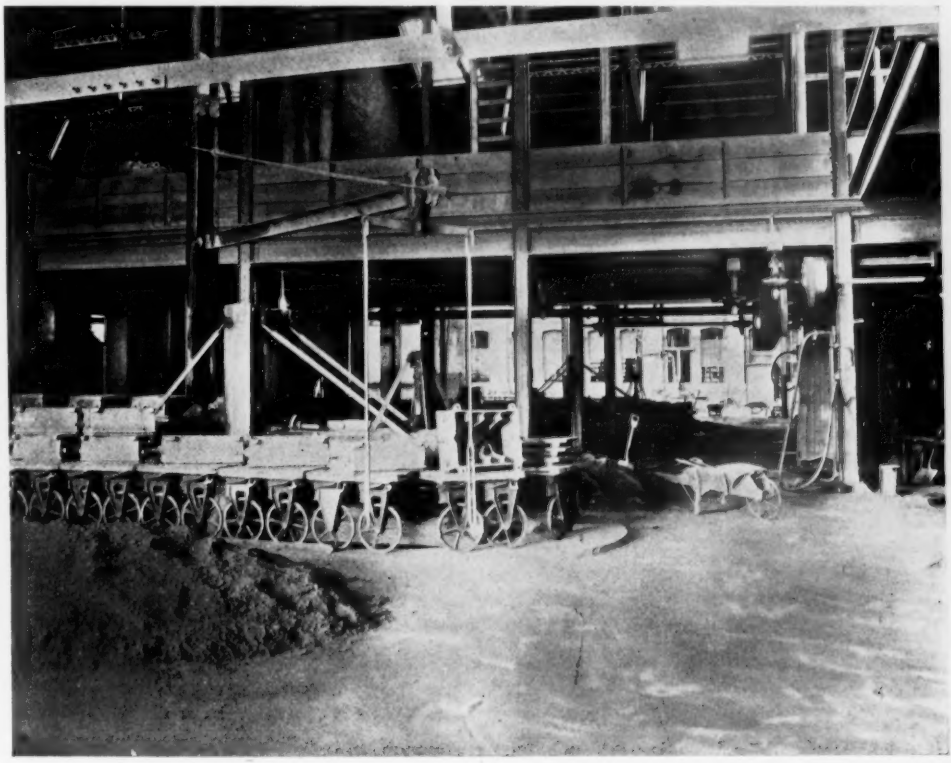


FIG. 4—SAND ROOM.

completed they are lifted from the machines by means of small hydraulic jib cranes, plainly shown in figure 3, and deposited on the tables of the flask conveyer, one crane serving two machines. As soon as the space within reach of the cranes is filled, the signal is given and the conveyer is moved forward about thirty feet, which brings the molds in line with core setters and finishers. Two molders are employed to set the cylinder port cores and do the finishing; the main cylinder and reservoir cores are set by unskilled labor; the conveyer moves forward again to another set of men, who put the molds together and clamp them ready for pouring. The flasks are then directly in the rear of the cupolas and in position for pouring, which work is done by still another set of men, who do nothing but carry iron and pour off all day long. The flasks are then moved by degrees to the sand room, the castings having cooled to a cherry red in transit, where they are shaken out by the aid of a small hydraulic jib crane shown in figure 4, which is a view of the lower end of the flask conveyer in the sand room. The gates are broken off and the red-hot castings rolled into the cleaning room to cool; the flasks are placed on the conveyer to be again returned to the machines. These varied operations, of course, all take place simultaneously, and the work is so arranged that each set of men finish their share of the labor so that at a given signal the flask conveyer moves forward without interfering with any part of the work. The output of four machines now in daily use is 300 cylinders and 280 reservoirs in a nine-hour work-day.

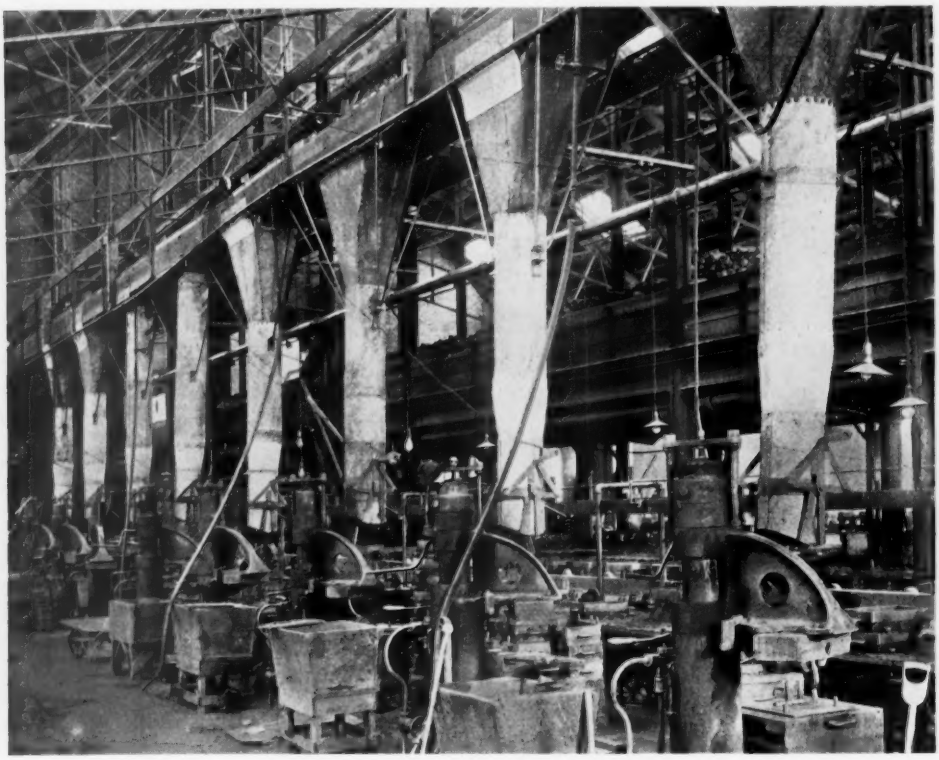


FIG. 5—SMALL MACHINES.

As the flasks are shaken out the sand is wet down and retempered with the addition of new sand; it is then wheeled in barrows to a revolving cylindrical screen. After passing through the screen where the lumps are broken and the sand is thoroughly mixed, it is carried by a bucket elevator to the overhead sand conveyer, which again carries it back to the machines, where the process is repeated.

The sand conveyor, which is manufactured by Heyl & Patterson, of Pittsburg, is of the reciprocating type. It consists of a main bar 230 feet long, composed of 3½ inch pipe, supported by arch bars as shown in illustrations; to this bar are secured rigid flight hangers, having steel flights suspended from hanger by flexible hinges, working in a box or trough 16 inches wide and 12 inches deep. The motion is gained by a crank which moves the conveyor bar backward and forward over a travel of four feet.

In figure 5 the machines for making the lighter castings are shown. These machines are situated on the opposite side of the shop from the heavy machines and directly in front of the cupolas; they differ from the others only in form of construction. In the two machines in the near foreground the controlling mechanism is plainly shown. When not in use the head is swung round at right angles with the stripping plate by means of a lever and the machine is controlled by the triple valve clearly shown in the illustration.

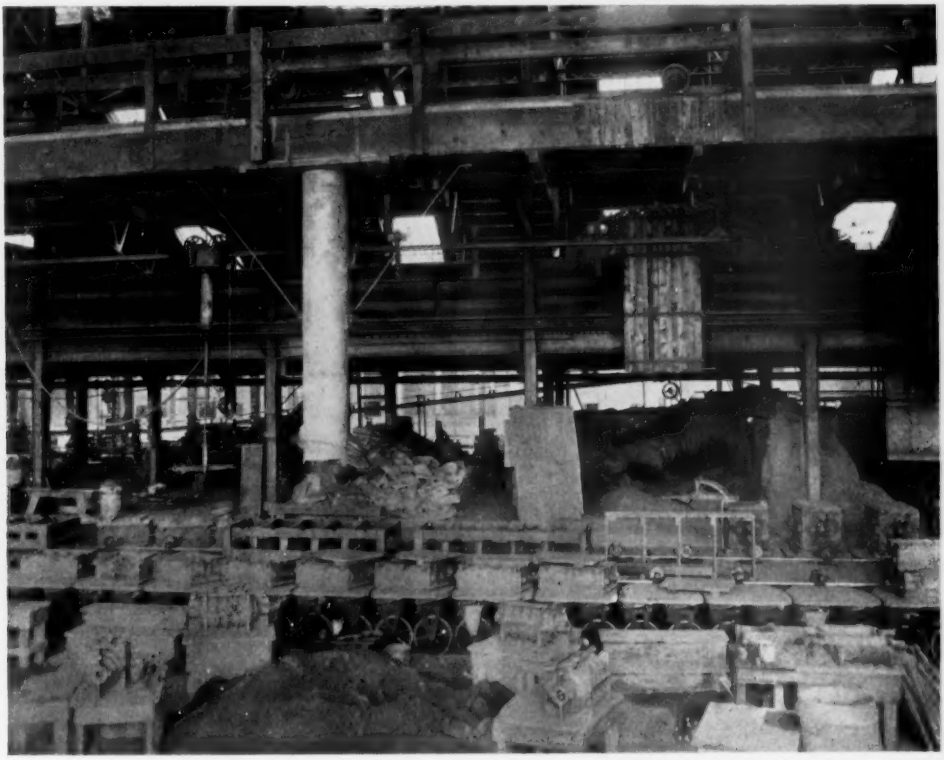


FIG. 6—CONVEYERS AND SAND BINS.

At each forward propulsion of the crank arm, the flights push forward the loose sand in the trough, the space of the travel in the backward sweep, the resistance of the sand, raises the flights to a horizontal position, allowing them to pass over and drop in behind the mounds of sand formed by the forward motion, so that the movement of sand is always in one direction. These conveyors require very little power, are entirely noiseless in operation, and have all working joints above and out of contact with the sand.

These machines are also worked in pairs, requiring the services of three men to each machine. The boxes alongside of each machine contain weak facing sand, which is mixed for all machine work with a Seller's centrifugal sifter shown in the background of figure 15.

The work of coring, closing, clamping and pouring is all done by separate sets of men and boys, the flasks being lifted from the machines to the flask conveyer by hand. The capacity of each pair of machines is from nine to twelve hundred molds per day,

and some very complex and difficult castings are made by the common laborers who manipulate the machines. The percentage of loss, especially on the more intricate castings and the cored work, is of course a trifle large, but the amount of good clean castings turned out by unskilled labor far exceeds the output of an equal number of skilled molders working by hand.

In the extreme left of figure 5 is seen a sort of inclined tramway leading from the core room, which is located in the second floor at the rear, above the cleaning room.

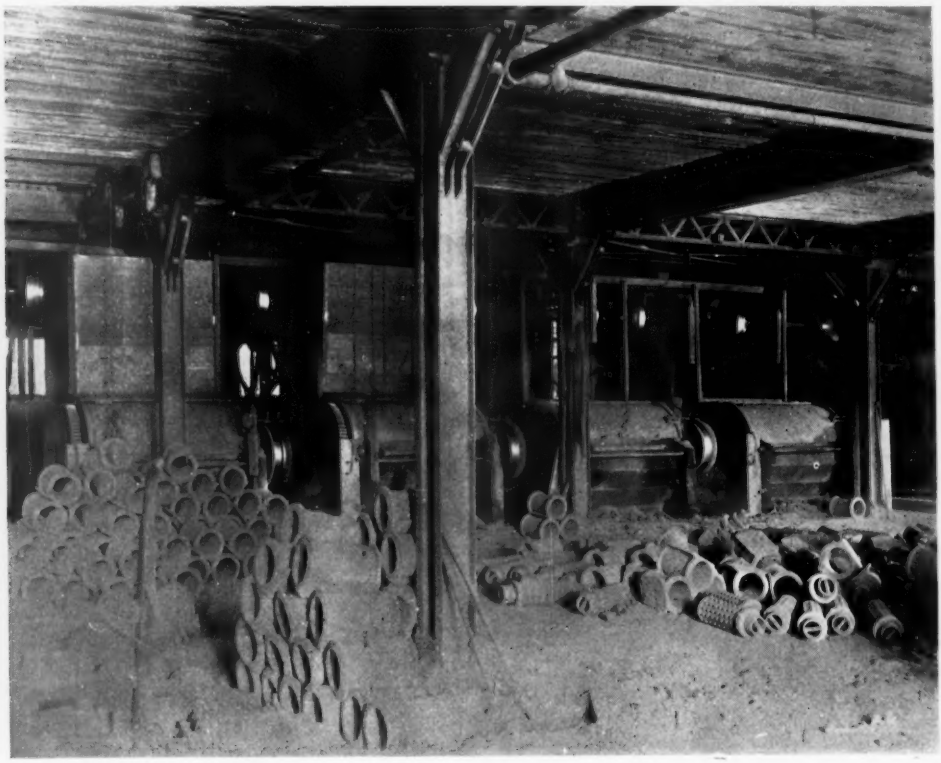


FIG. 7—CLEANING ROOM.

A small carriage operated by a rope cable wound on a drum carries the dry sand cores from the core room to the machine core setters; the green sand cores, of which there are several varieties used, are made in the foundry.

The flask conveyer, which is plainly shown in figures 3, 4 and 6, was designed and built by the Link-Belt Engineering Co., of Philadelphia, and is covered by a pateat which they own, and the continuous molding system as a whole is covered by another patent, under which they are exclusive licensees. The conveyor consists of a number of platformed carriages about 2x2½ feet, strung on an endless link belt, which travels round two 8-feet sprocket sheaves in an elongated ellipse 150 feet long by 10 feet wide. On the outer edge a single rail is placed on a level with the floor, upon which the two outer wheels of the carriage, 12 inches in diameter, grooved to fit the rail, travel. On the outer edge of the inner stationary platform, which occupies the space, 5 feet wide, around which the conveyer travels, is bolted a T rail upon which runs a 6-inch grooved wheel, from which the inner side of the carriage is hung. The whole forms an endless movable platform which moves up one side of the ellipse and down the other. The motive power is a 25 horse power Westinghouse engine, and the conveyer is controlled by a friction clutch operated by a lever at a convenient point on the floor of the foundry.

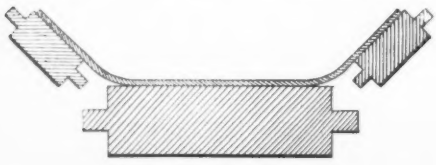
Figures 7 and 8 show two views of the cleaning room looking from either side to-

ward the center. In figure 7 the brake cylinders are shown stacked in rows as they are rolled in from the sand room. The main cores in both cylinders and reservoirs are made of green sand, and the first work is in removing the core barrels and arbors, of which a special description is reserved. As in all other departments the work is here systematized and proceeds with dispatch. As the castings are shaken out of the flasks they are rolled into the cleaning rooms and stacked in rows. One man removes the cylinder core barrels, another the collapsible core arbors from the reservoir. With one stroke of the sledge hammer the core barrel is driven from the cylinder and the arbor is collapsed in the reservoir; the former is then ready for the cleaning barrels, while with the latter it is necessary to pour out the burnt sand from the narrow opening in the neck and remove the various pieces which compose the core arbor by means of an iron hook. The castings are then cleaned in rotary barrels in the ordinary way, 20 rumbling barrels being used in this operation. In figure 8 the emery wheels are shown where the castings are ground and finished, ready for shipment to the machine shop. The illustration, figure 8, is remarkable chiefly as a triumph in the art of photography. This corner of the cleaning room is so dark that it is necessary to work by electric light, yet an excellent photograph was secured by time exposure without artificial light. Nearly all of the small castings shown in this illustration are machine molded. The variety and intricacy of the patterns may serve as an example of the really difficult castings which are here turned out by the thousand daily on molding machines.

FIG. 8—GRINDING ROOM.

In getting rid of the accumulation of burnt sand, dust and other residue of the cleaning barrels, a novel sand conveyer is in use, which is both comparatively cheap in its construction and effective in its action. Underneath the cleaning barrels are a set of sloping bins into which the dust and refuse

drops through gratings. Beneath these bins is the conveyer, a broad rubber belt, traveling on wooden pulleys, whose edges are



BELT CONVEYER.

dished by side rollers set at an oblique angle to the center rollers. There are two of these conveyers which carry the refuse from four rows of cleaning barrels and dump it onto a third conveyer, running at right angles to the others, which carries the sand to an ordinary bucket elevator, by which it is carried to a large closed bin in the core room above. A chute leads from the bottom of this bin, through which the sand is loaded into a closed box car, to be hauled out and dumped.

As the process of melting and casting is carried on continuously for nine hours each day the cupola practice in this shop must of necessity differ from that of most foundries where the heat is taken off in from one to three hours. The cupolas consist of four Colliau shells, two of 72 inches and two of 60 inches diameter. The Colliau system of blowing, however, is not in use. The cupolas are contracted above the upper row of tuyeres, the latter are closed, and the air is admitted only through the lower row.

When the foundry is running in full—that is, night and day—three cupolas are employed alternately from six to seven hours each, with the fourth held in reserve; the amount of metal melted daily averages 140 tons. Since the completion of the new foundry annex the necessity for night work will only exist in case of an extraordinary rush of work, but the increased capacity of the foundry created a greater demand upon the cupola capacity per hour. No trouble was experienced in melting the metal, from 12 to 14 tons per hour, but as all of this metal must be handled with small shank ladles

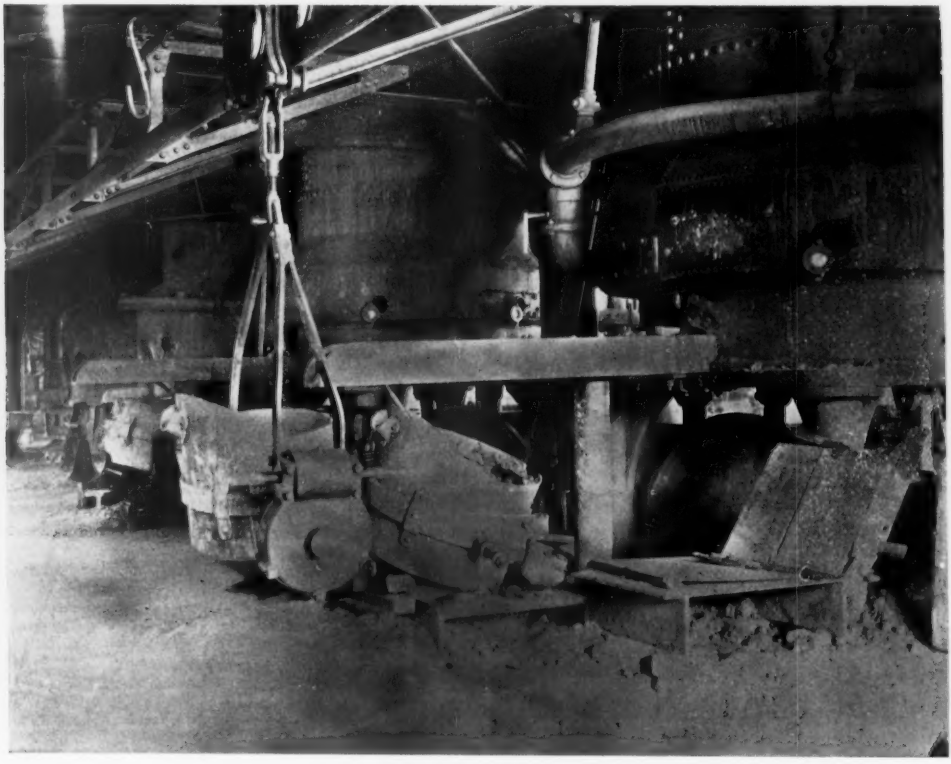


FIG. 9—THE CUPOLAS.

the difficulty to overcome was in taking the metal away as fast as it melted. The two larger cupolas, as at present constructed, present a novelty in cupola practice. The slag hole is placed at the side, and the cupola is breasted front and rear. In the rear a single trough is placed, and in front two troughs, one about six feet long, the other three; separate tapping holes lead into each trough and three streams may be run from the cupola simultaneously. The long trough is used in filling the ladle which conveys the metal to the new foundry by means of an overhead trolley. Illustration, figure 9, is a view of the cupolas, showing the two lad'es and the posit'on of the troughs. While the ladle is filling, the metal flows through the shorter trough into a tipping ladle, from which the shanks and hand ladles are filled. In this manner the problem of handling an immense amount of metal in shanks and hand ladles has been solved. The cupolas are blown by a No. 9 Sturtevant blower at a 9-ounce blast pressure.

In mixing the metal neither the breaking test or any special chemical analysis is used. The analysis furnished by the furnaces with each carload of iron is used as a basis for the mixture, and the result is judged by the fracture of a test bar cast in a chill mold from time to time during the heat. The ratio of fuel to metal is about 1 to 10; this ratio is arrived at, not by the daily reports of a cupola tender, into which considerable guess work usually enters, but by comparing the amount of coke consumed monthly with the amount of iron melted in the same time. Limestone is used as a flux and the slag hole is kept open almost continuously through the heat. As is usual in the gas districts, natural gas is used in drying the ladles, the gas being conveyed in rubber tubing from the main pipes to circular burners, which lie on the bottom of the ladles, the flame being projected against the sides.

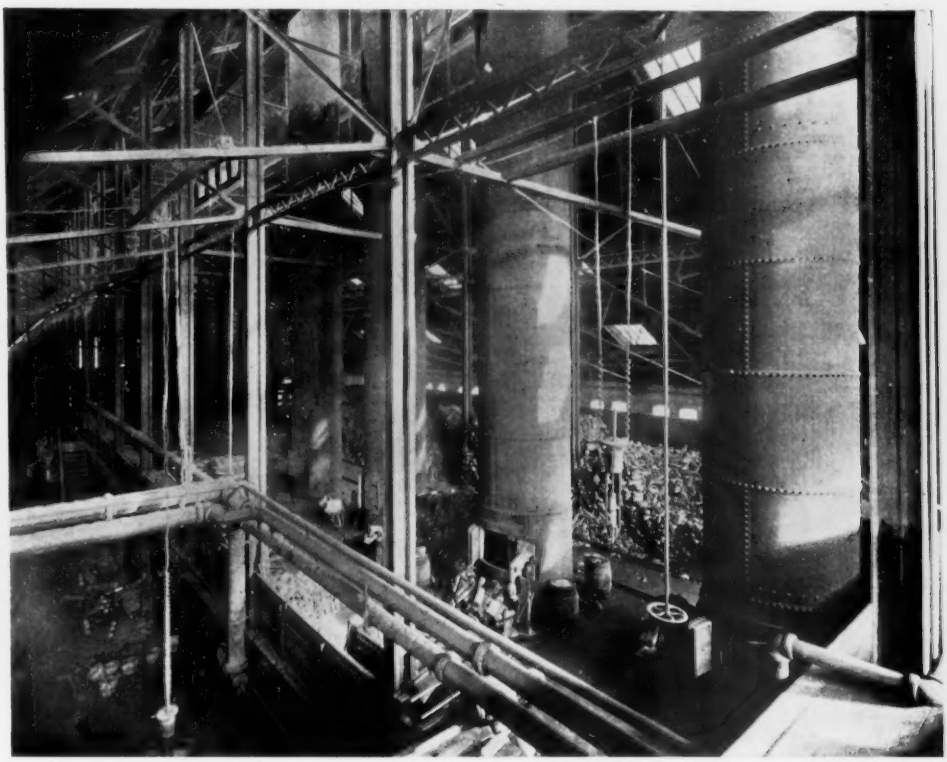


FIG. 10—CUPOLA SCAFFOLD.

The cupola scaffold, of which a view from the top of the engine room is shown in figure 10, is a substantial structure about 25 feet wide extending through the foundry from end to end, constituting practically a second story in the foundry. The structure is supported on wrought iron columns and girders, the flooring being constructed of 8-inch oak boards set on edge, and in the vicinity of the cupolas the latter are protected underneath with iron sheathing and a layer of concrete to avoid any danger of fire. Upon this structure a track is laid, and the shifting engine employed in the plant pushes the cars of fuel and metal onto the platform, where they are unloaded in proximity to the cupolas. The molding sand is also brought up in the same manner, and unloaded into the sand bins shown in figure 6. The front of this platform is occupied by a machine room, in which are located the engine and cupola fan, also the engines and controlling mechanism of the flask and sand conveyers.

In the rear of the building over the cleaning rooms the platform is extended to either wall, forming a complete second story, and this is occupied as a core shop, two views of which are shown in figures 11 and 12. There is little of interest to note in the core room, there being no machines used in this department either in making cores or in mixing sand. On account of the large number of special cores used a large saving is effected in making the cores in one piece and drying them on special core form plates. The drying is done in 24 Millett core ovens, heated by natural gas. This shop is said to have given the drying and preparation of its cores an unusual amount of attention and their selection of the Millett oven and the large number they are now using is a splendid tribute to their efficiency. But dry sand cores are the least interesting of the special

FIG. 11—A SECTION OF CORE ROOM.

cores used in this foundry; the green sand cores used in the cylinders, reservoirs and other special castings made upon barrels and collapsible core arbors will attract more attention from the average foundryman.

Prior to 1884 the cores for the reservoirs were made of dry sand secured by rodding, and aside from the cost of making and drying, six cores being considered a day's work for a skilled coremaker, the core smoke became so annoying in the thickly populated neighborhood in which the shop was then located that the citizens threatened to take legal steps to abate the nuisance. Now, by a strange coincidence, two foundry foremen of Allegheny, neither of whom had any connection with the Westinghouse company or with each other, were each working out their ideas of a collapsible core arbor designed to carry a green sand core similar in construction to the air brake reservoir, and both had succeeded in their efforts—Mr. Wm. T. Mobberly in making an arbor which would carry a green sand core for coring out the air chamber in an ordinary pump, and Mr. Robert Taylor, now president of the Taylor, Wilson & Co., Ltd., of Allegheny, in making a collapsible arbor for carrying a green sand core in a four-sided box column. Mr. Taylor was about to apply for a patent on his invention when Mr. Mobberly called upon him with a model of his core arbor. Instead of seeking to antagonize each other they concluded to pool their issues, and, selecting the best features of their separate inventions, they applied for and secured a patent on a collapsible core arbor, dated March 11, 1884.

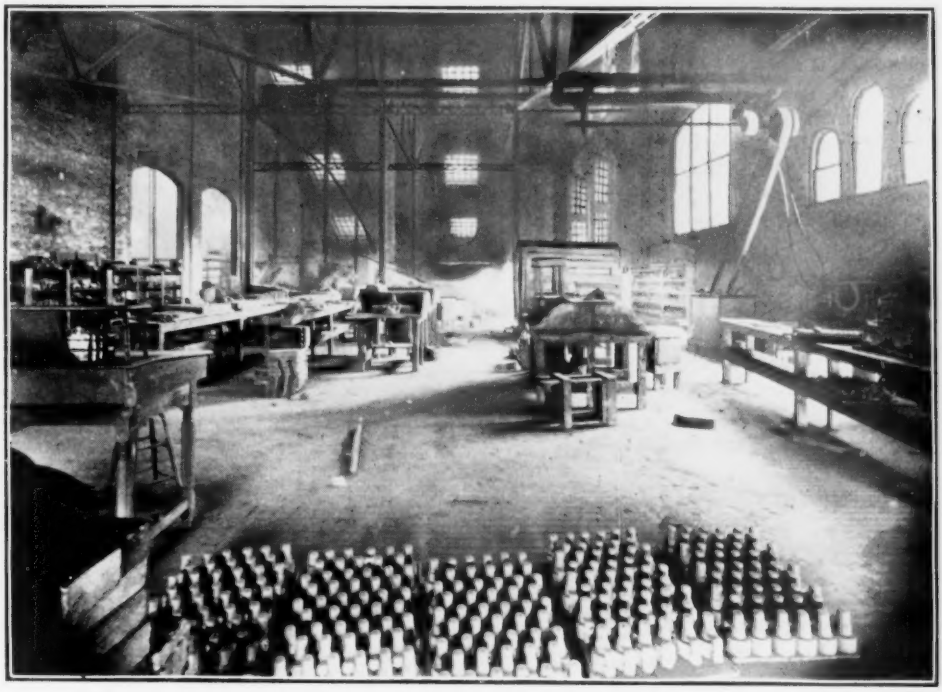


FIG. 12—THE CORE ROOM.

In the meantime, before the patent papers were issued, Mr. Taylor learned of the difficulties with which the Westinghouse company had to contend, and offered to make a green sand core which would not only abate the smoke nuisance, but would lessen the cost of core making at least 50 per cent. This offer was immediately accepted by the officials of the company, and the core arbor and special box now in use was the result. Before the patent had issued on their invention Messrs. Mobberly and Taylor

had transferred all rights in their core arbor to the Westinghouse company for a valuable consideration.

In the illustration, figure 13, is shown a cylinder and a reservoir core of green sand, together with core barrels, arbor, boxes and tools used in making the same. A is the reservoir core and B the collapsible core arbor used in carrying the weight of the core. In the casting the core is completely surrounded with metal three-eighths of an inch in thickness, the only openings for the escape of vent or removing the core being the two-inch openings at either end. It will thus be seen that the lessening of the cost of core making was not the only advantage gained in adopting a green sand core for this casting. The shell being thin, the heat was insufficient to burn out the binding materials, and the half burnt core had literally to be dug out through the narrow opening.

Referring again to the illustration, C is the lower half of the core box; D is the upper half in which is an oblong opening for ramming the core up to the point where the strike E is used to form the top, when the cover F is tamped down to smooth the top and form the imprint of the ribs shown in the lower half of the box. A cylinder core and barrel is also shown in figure 12. This form of barrel is in common use and requires little description. The barrel is placed upon braces grooved to fit the neck ZZ, a handle fits in the end of the barrel with which to revolve it, the sand is built up by hand and the outline of the core is formed to size by a special "strike." Several other special cores are also made in green sand for use in smaller castings, but the two described above will cover the principles employed in making the others.

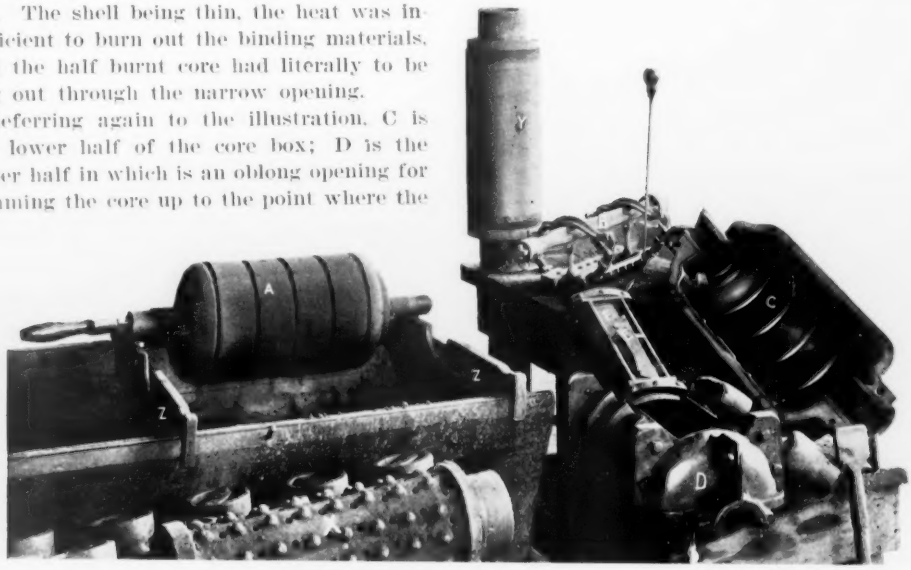


FIG. 13—CORES, BOXES AND ARBORS.

In figure 14 a view of the new addition to the foundry is shown, this department being intended for machine molding only. All of the molding machines and much of the special rigging used in the construction of the addition to the foundry, including the flask conveyer, which is built on a different model and is a much more substantial structure than the two in use in the main foundry, were built at the air brake shops. Hydraulic pressure is done away with entirely in the new department, and all of the machinery, with the exception of the sand and flask conveyers, is operated by compressed air.

Floor molding, which has not been entirely superseded by the molding machines, presents some peculiar features in this foundry, chief among which is the maximum amount of work turned out in a minimum floor space and with but a limited flask equipment, compared to the size of the day's work. Yet there is no overcrowding and each molder has ample flasks for his need. The illustration, figure 15, is a view of the molding floors on the right side of the shop. Although the floor space shown seems to be, and is, limited in extent, yet ten molders find ample room not only for their day's

work, but for piling their flasks when not in use. As the iron is running from the cupola continuously throughout the day, and the molder may secure a ladle and pour off whenever and as often as it may be convenient for him, it follows that it is only necessary for him to ram up a sufficient amount of work to equal the capacity of one or two ladles of iron; he then pours off and works on another flask while his castings are cooling. As soon as the castings are set sufficiently he shakes out his flasks, drags the castings to the front of the heap and cuts back the sand before the moisture has time to burn out of it. The process of molding, casting and shaking out is thus repeated many times a day. The floors are so arranged that the molders work in pairs, cutting their sand to a common heap and piling their flasks on either side.

The flasks for standard work are all iron or, in the case of the larger flasks, wooden sides bolted to iron ends and cross bars. The smaller flasks have planed joints and round riveted pins fitted to drilled holes in the plates.

Besides the regular air-brake work many castings for special machinery used in the plant, both for new machines and repairs, are made in the foundry. On this class of work wooden flasks are used and the molders are paid by the hour. On all regular work in every department of the plant piece work is the rule.

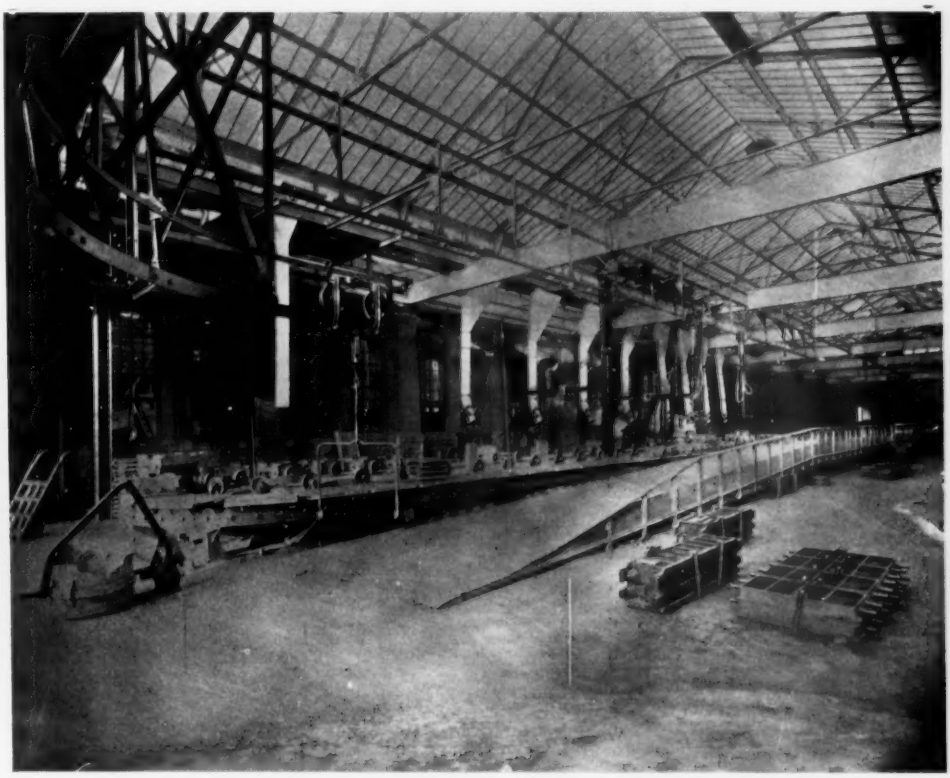


FIG. 14—VIEW IN NEW FOUNDRY.

Each piece of casting, whether machine or floor molded, is subjected to a close inspection for defects, such as sand or slag holes. The castings must be absolutely airtight, as the slightest hole in any of the castings which go to make up the air brake would provide an avenue for the escape of the compressed air and render the brake ineffective. Aside from the inspection for visible defects each piece of hollow casting entering into the construction of the brake is tested under an air pressure of 140

JAMES M. SLEETH.

pounds to the square inch, the normal working pressure being about 80 pounds, first for strength, with precautions against accidents from the bursting of the casting under the enormous strain, then for leakage by painting the surface of the casting with strong soap suds when the slightest leak will then show an air bubble. Finally, after all of the parts are assembled, the completed brakes are tested in a rack containing 60 brakes under conditions similar to those which would obtain in actual use, only at a much greater than the normal working pressure. First the slow stop is used, and the brakes are seen to slowly tighten from the engine to the rear of the train; then the emergency stop is used, and the brake pistons fly out like battering rams, setting every one of the 60 brakes in less than two seconds. These tests are repeated until it is seen that every brake is in perfect working order, when they are disconnected and are ready for shipment or storing in the warehouse. This severe test requires that the mixture of metal be close and homogeneous, and that the castings be absolutely clean and free from any defects.

In the ordinary foundry a special wash room is an undreamed-of indulgence, a dip in a bucket or at the water butt against the

FIG. 15—MOLDING FLOORS.

wall, drying afterward on a towel that might, with little assistance, stand alone, being the acme of luxury to the molder in such establishments. In the Westinghouse foundry, and as well in all of the other departments, are commodious wash rooms and lavatories supplied daily with soap and clean towels; 1,700 clean towels are furnished each week, where the workmen may refresh themselves with a good wash and a change of clothes, leaving the dirt and grime of the shop behind them when they leave at night.

Something equally remarkable to any of the other characteristic features of this shop is that during its existence of over 27 years it has had but two foundry foremen—father and son. Mr. J. M. Sleeth, well known to many of the molders of the older generation, was the first foreman and was succeeded by his son, S. D. Sleeth, at his death. The elder Sleeth was born in Ireland and learned his trade in Mitchell's foundry, and afterward worked at Nicholson & Pain's

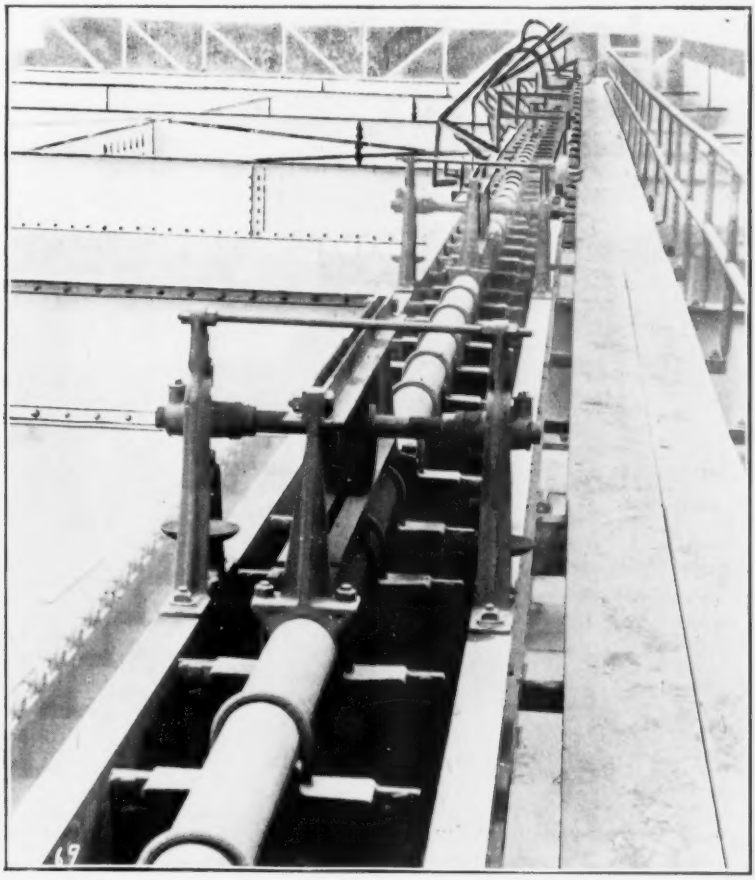


FIG. 16—HEYL & PATTERSON SAND CONVEYER.

Many other features of this plant are worthy of more than passing notice, but lack of space forbids even a brief mention. This article would be incomplete, however, without a mention of the telephone system, with a central exchange in the office of the superintendent, which places him in ready communication with the heads of the various departments and each foreman in touch with his assistants or any of the other departments.

foundry, one of the oldest shops in the city, near what is now called lock No. 1 on the Monongahela river, but was known among the old-time molders as "the dam." He left Nicholson & Pain's to take charge of the foundry of Hill, Kane & Faber, Pittsburg, in 1862. Later he enlisted in the 54th regiment, P. V. I., and was with Grant in front of Richmond near the close of hostilities. Two days before Lee's surrender he was

taken prisoner at High Bridge, but was paroled, and at the close of the war honorably discharged. In 1870 he took charge of the Westinghouse Air Brake Co.'s foundry, which position he held until his death in 1889. In 1888 his son, Mr. S. D. Sleeth, was made assistant foreman in the foundry, and upon the death of his father he succeeded him as foreman, which position he still holds.

The writer is indebted to Mr. H. H. Welsh, Jr., superintendent, and Mr. Sleeth for many courtesies and information which it would be impossible to gain from any other source in the preparation of this article.

A New Method of Making Brake Shoes.

By inserting a network of "expanded metal" in the mold intended for brake shoes, the Sargent Company, of Chicago, have succeeded in making a casting of unusual durability and uniformity. Fig. 1 shows a bundle of expanded metal sheets, which when placed in the mold effect a minute subdivision of the space to be filled by cast iron. Fig. 2 is a cross sectional view of the brake shoe after casting, the angular location of the steel strands affording a constantly changing wearing surface. Fig. 3 shows the appearance of the face of the shoe. It is claimed for this construction that the small particles or granules of cast iron, which are worn off the ordinary shoe by friction and lost, are by this method caught by the many barriers of soft steel, where they lodge until further reduced in size, thus adding to the friction and increasing the durability of the casting. The Sargent Company have published an illustrated booklet, further describing this method, and we have called attention to it here, because it appears to us as if there are a number of castings made for different purposes, where this process of utilizing expanded metal could be used to advantage, making the castings more durable.

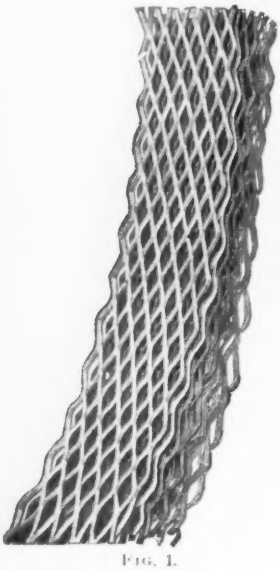


FIG. 1.

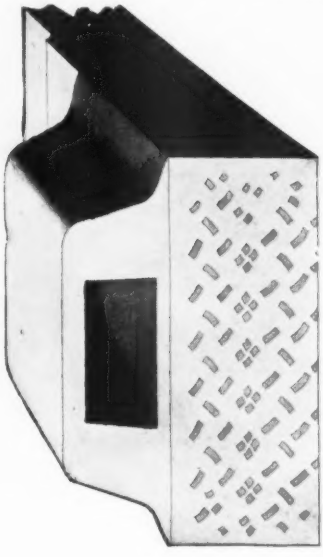


FIG. 2.

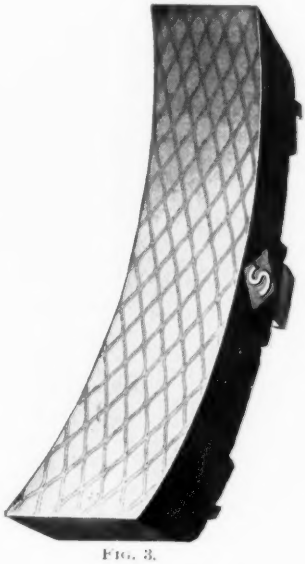


FIG. 3.

Small Taps.

John Hammerstein's foundry enlivened that end of the block yesterday. It presented a busy appearance. John spent the day, with a force of extra men employed, in running off a heat, turning out moldings of several kinds. N. Stebler's iron fence was cast, a hot air furnace was made, and there was a large amount of grates and smaller work. In all, about 2,500 pounds were cast. Mr. Hammerstein has been kept busy of late turning out orders.—Savanna (Ill.) Times.

It may be fun to try to hit a fly with a crowbar, but it is a heap of energy wasted just the same.

A TECHNICAL JOURNAL DEVOTED TO FOUNDRY INTERESTS.

THE FOUNDRY

Published Monthly by

"The Foundry Publishing Co."

DETROIT, MICH.

JOHN A. PENTON,

EDITOR AND PROPRIETOR.

DETROIT, DECEMBER, 1897.

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If you fail to receive your paper promptly, please notify us.

THE FOUNDRY

Is issued promptly on the first of each month, and will spare no endeavor to furnish valuable news and information to those interested professionally or incidentally in molding, melting, mixing of metals, foundry management, etc. Persons connected with any of these lines of industry will confer a favor upon the Editor of this Journal by sending him news from their section of the country pertaining to the foundry interests, particularly individual theories and experiences of practical value.

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Trade Outlook.

The great movement of pig iron during October has resulted in giving producers enough orders to keep them busy for some time to come, and there is no disposition to struggle for new orders at a concession in price. The reduction of stocks has placed the pig iron market on a better basis, though the uncertainty of the cost of ore and coke, together with the possible advancement of wages in those industries has had the effect of retarding the closing of contracts for 1898 delivery.

No radical movement resulting in abnormal prices is likely to take place, as it is recognized that the importance of our foreign markets will not permit any weakening in our present stability. A number of foundries are showing what they are pleased to term their backbone, in refusing to bid on work at current quotations, but it is also to be noted that their shops are largely idle, while their competitors, who have abandoned their former expensive shop practice for improved methods, are prepared to continue at present prices indefinitely. No material advancement in the price of castings is to be expected, unless the cost of pig iron and coke increases perceptibly more than the present situation indicates.

The car works and other shops depending on the prosperity of the railroads to keep them active are increasing their output. Considerable interest is taken in the enforcement of the law, requiring railroads to equip their rolling stock with safety couplers and train brakes. The limit of time granted the roads to comply with this law expires Jan. 1, though further extensions are to be expected. In this connection it should be noted that this law alone is not to be credited with the installation of improvements. The managers of railways are ever ready to accept improvements which will reduce the cost of operation, and may be relied on to make changes as fast as the financial conditions of their properties permit, irrespective of laws enacted upon the subject.

The foundries engaged in the production of specialties continue to operate their works on an extensive scale, many working overtime with orders enough ahead to warrant them in doing so for some time to come.

Scrap Heap.

We have received the following letter:

Editor THE FOUNDRY:

The article in your November number on "Let them be useful as well as ornamental," is so out of keeping with your usual broad spirit that I must take issue with you.

So far from discouraging the study of political economy, I think you should encourage it. It explains the science of government and as every citizen takes a part in this he should know what he is about.

You think it absurd that a mechanic should write treatises on the single tax because in 99 cases out of 100 they have nothing to tax. The mechanic who writes such treatises would, if you questioned him on this point, probably tell you that the reason they had nothing to tax was because we do not have the single tax. But in regarding this as absurd you simply show that you do not understand the single tax, for it is so simple and easy to understand that any school boy can grasp its principles, but so little is it understood that there is need for mechanics to teach others—even editors sometimes require it.

Now a knowledge of political economy may not enable a man to drive a nail quicker or straighter, neither will a knowledge of the laws of health do so. But the latter will enable a man to keep himself free from physical disease and a right understanding of political economy will enable men to keep the social state in a healthy condition. It is not in such a condition now. When, in a country as rich as ours in natural resources, we see hundreds of thousands of men willing to work and unable to find it; when we can't pick up a paper without reading of deaths from starvation and suicides from fear of want, when our manufacturers favor a robber tariff and our workmen favor the shutting out of the country of others—whose only crime is their poverty and the fact that they came later than those already here—there is a crying need for the study of the natural laws which govern the social organization.

The single tax aims to right wrongs. It sees that every man has an equal right to the bounties of nature, viz., the earth, the sea, the air, the sunshine and such things as man has no hand in producing. Its mission is to make these rights operative. Men are deprived of them now and natural laws are transgressed and we pay the penalty in social disease. Anyone who sees this and does not cry out against it is no true man and is wanting in his duty to his fellows, his country and his God.

The single tax is no quack remedy—it is no "gold cure" nor "silver" cure either. It sees that the earth is the great storehouse from which all that man needs must be drawn. It would stop the cornering of the earth—would make it so that no man would dream of taking a piece of land except for use. Under it wealth would be earned—the unearned increment would go into the public till. No taxes would be levied in any form on industry or thrift. In short, it is simple justice and that is what we most need to-day. I urge its study.

New Castle, Del. HAROLD SUDELL.

We print the foregoing, not because we think our correspondent's criticism is well-founded, but rather that it gives us an opportunity to explain our position.

We have never thought it wise to devote any space in our columns to the discussion of matters other than those that referred directly or indirectly to the foundry business.

This may have been a wrong or it may have been a right decision, at all events, it has seemed to work quite satisfactorily in our case.

The single tax proposition or other reforms are all right in their place, but it has seemed to us that their discussion would be as inappropriate in a periodical, such as this aims to be, as would the introduction of religious or political matters.

It is better to do or try to do one thing well than to divide our ammunition and attempt too much.

This is an age of specialties, and a subscriber to THE FOUNDRY for or expect or want to see its space devoted to the discussion of the thousand and one matters that legitimately belong to the daily paper or literary magazine.

The writer of this has long been a believer in the justice of the single tax doctrine—but this is no place to air that fact or give reasons therefor.

What has seemed to be true in our case, we have thought was equally true in many others, and our correspondent refers specifically to the fact that we especially won-

der why publications devoted exclusively to the interests of trades unions, etc., devote so much space to those subjects and relatively speaking, so little to the particular requirements of the trade or occupation represented. For instance, we have in mind publications in the interests of machinists, locomotive engineers, firemen, etc., that contained large departments devoted to everything from continued stories to cooking receipts, that had a ladies' department and columns after columns about the oppressions of capital, etc., but little or nothing concerning the occupation of its readers, an almost entire absence of any effort to keep them thoroughly informed or furnish any but a very small amount of technical or practical information.

We think and have always thought that these papers miss a magnificent opportunity and one that if thoroughly utilized would make them a power in the land.

A Splendid Showing.

We have endeavored always to have our readers feel a more than ordinary degree of interest in THE FOUNDRY. It has been our desire to make each subscriber take a sort of personal pride in its success, to cooperate with us to the fullest possible extent in our effort to improve the paper itself, and to extend its influence abroad.

This being the case, we feel sure that patrons will be pleased to know of the really wonderful growth our subscription list has undergone during the past few years. During the most of this time the business of the country has suffered from a depression never before equalled, in which the foundry business has endured more than its share.

In spite of these discouragements, this paper has shown a steady growth varied only by a slight falling off during the latter portion of 1896 and the early months of 1897, when we thought it advisable to discontinue temporarily our usual amount of missionary work, but the loss indicated it will be seen amounts to almost nothing compared with the growth during the whole period.

The following table shows the comparative gains and losses in our subscription list from January, 1893, to November 1, 1897. Each month is compared with the same month of the previous year: Thus, in March, 1895, we gained 78 per cent over March, 1894, and in August, 1896, we lost 11 per cent over August, 1895:

Month.	1894.		1895.		1896.		1897.	
		Per ct.		Per ct.		Per ct.		Per ct.
January	G	51	G	2	G	82	L	19
February	G	8	G	9	G	7	L	9
March	G	20	G	78	G	10	G	35
April	G	38	G	80	G	76	L	17
May	G	57	G	60	G	39	L	13
June	L	14	G	48	G	197	L	1
July	G	46	G	201	G	2	G	32
August	G	21	G	119	L	11	G	151
September	G	82	G	41	L	17	G	115
October	G	86	G	10	L	12	G	65
November	G	64	G	9	L	4		
December	L	9	G	28	G	94		

These figures are absolutely correct and we believe our subscribers and advertisers will be as well pleased as we are ourselves.

A Merry Xmas.

As this is the last issue of THE FOUNDRY previous to Christmas we take pleasure in wishing our many friends a Merry Xmas.

We have, in our humble way, tried to add our mite to the occasion in this number, which, in harmony with our established custom, has been prepared with extra care and is, we hope, up to our regular standard.

The gradual and surprising increase in the popularity of this paper since its inception, as indicated elsewhere, and during a period of unusually severe business depression, leads us to believe that with the revival now here, we will be able to gradually carry out some long projected improvements.

Not only have foundrymen been quick to appreciate the value of this paper, but as will be seen by reference to our advertising pages, have been equally as liberal in their patronage.

It has been our policy in years gone by to publish at this season an exceedingly large number of copies and send one to each iron and steel foundry on this continent that were not already subscribers—as a sample copy.

With this as a basis, we have at these times occasionally had a very liberal degree of support from advertisers, and it pleases us to think that we have never yet held out

any inducement that we have not scrupulously lived up to.

In future, however, we will never publish any more copies than the number actually necessary as we do not believe it is good business policy and is no longer necessary.

There is no one engaged in the foundry business in America who has not received one or more sample copies, if they are not already subscribers, so they know what it looks like, and if they are progressive, wide awake and ambitious foundrymen they take it, and if they are not, they probably do not. In any event, sending them sample copies will not improve matters.

Then again, so far as advertisers are concerned, this special issue business has been worked to death, and besides there exists a pretty well founded suspicion that the inducements so often held out on occasions of this sort in the way of extraordinary large issues, are but seldom lived up to.

THE FOUNDRY has no free list. We require about 200 a month for exchanges, advertisers, etc., and the balance of our entire issue goes direct to our subscribers.

We keep up, however, all the time an aggressive campaign all along the line in behalf of our subscription department, with a result that is peculiarly surprising and gratifying to ourselves.

But very few trade journals in America have a circulation in excess of THE FOUNDRY, and before the end of 1898 it is our purpose to still further reduce the number.

His Record Might Have Been Otherwise.

George M. Pullman is dead.

In his way he was a very successful man, but there are different kinds of successful men.

There can be no denying that he had considerable genius which, rightly applied on a much needed article just at a time when owing to conditions in this country there was a grand opportunity, made him very prosperous.

Added to his inventive and mechanical ability there was a more than usually large share of hard-headed persistency and tenacity of purpose, that were of the greatest value to him during many epochs of his career.

But for all these attributes, commendable in themselves, George M. Pullman was far short of being the ideal man; in fact, much farther short of it than a man possessed of his opportunities ought to be.

This was shown most conspicuously to the world during the great Pullman strike, when he turned a deaf ear to the importunities of a large number of prominent citizens and disregarded the known wishes of nearly the entire populace of America, refusing point blank to arbitrate or in any manner meet half way his employes and consider their grievances.

The position taken by Mr. Pullman concerning these employes previous to this might have been right or might have been wrong, we do not know that really many people are competent to judge all the details impartially, but the time has gone by when any employer or employes of labor, great or small, can afford to take the position so stubbornly adhered to by Mr. Pullman at that time.

It left the impression in the minds of every unprejudiced American that these were matters the company were afraid to have investigated, otherwise why should any feeling of false pride or superficial dignity have permitted them to refuse to prove the assertions they so arrogantly made as to the company's inability to do any better by their employes.

Throughout all that trouble and weeks of disorder, rioting and bloodshed and stoppage of business, George M. Pullman remained stolidly indifferent to the frightful havoc that he could have prevented had he so determined.

And now he has gone, gone never to come back to earth again, and leaves over a million dollars to found and endow some sort of an educational institution at the town of Pullman.

Had he left ten times as much, he could never have bought the esteem and regard of the American people, who are beginning to think that there are other methods of proving one's manliness and uprightness and true-heartedness rather then endowment of schools, universities and public libraries, and wresting the means with which to do it from their employes in a way that is often very questionable .

A very small part of that million would have straightened out those little differences

a few years ago, and the world would never have known the true inwardness of Pullman town as portrayed in Frank Leslie's and other papers at that time.

In that event, Mr. Pullman might have left a name and reputation behind him that the American people—always quick to appreciate enterprise and ability—would have been glad to honor, and the other side of the picture never been known.

To make our point clearer we need only compare the life, death and present popular esteem of a man, who died almost the same time, named Henry George.

We are not indorsing or in any way commending any of the latter's ideas, but some of the scenes and incidents of his taking away, funeral, and wave of human sympathy that swept around the entire universe, would indicate that it was not needful in his case—even if he had the means—to provide for his own monument.

And This is Not All, Either.

Every once and a while the old canard about lack of improvement in foundry methods and skill is sprung by someone whose liver is out of joint.

We heard the other day of a contract for 200 good-sized cone pulleys that had been filled by the Buckeye Foundry Company, of Cincinnati, Ohio, with the loss of only two, all the rest having been accepted, turned and polished, being found solid and even in every particular.

Then again, we know a year or two ago of one molder, now foreman in a shop in Western New York, who had made 360 large-sized steam hammer frames, the smallest weighing 1,100 pounds, without a single loss and the molder did not think he had done anything wonderful, either.

Only those, however, who know of the innumerable matters requiring every time the molder's best care, can appreciate such a record.

Not Guilty.

In a recent contribution to the Engineering Magazine, Hiram S. Maxim dwells on "The Effect of Trade Unionism Upon Skilled Mechanics," in the course of which he says: At the present time the trade unions seek to specialize work and to put every obstacle in the way of learning more than one thing.

Mr. Maxim is evidently referring to conditions in England, though we can hardly conceive of a trades union confining its members to learning one thing. Every union we know of deplores the specializing which has taken place and several are at the present time making efforts to induce the employers to agree to a uniform apprenticeship system, whereby the mechanics of the future can obtain a broader knowledge of their respective trades. If asked to express our opinion on the subject we should say that the employer is seeking to specialize work and is keeping apprentices from learning more than one thing. The fact of the matter is that every employer tries to utilize the services of his employes to the best advantage, regardless of the effect upon the latter, and it may be expected that this condition of affairs will continue, though we feel that the trades unions should not be blamed for producing, what they have tried their utmost to prevent, the specialist.

Mr. Maxim was born in Maine and ought to have sufficient interest in his fatherland to keep posted on its general affairs, especially if he intends to write of our conditions. That several years of residence abroad has made him somewhat unfamiliar with us is evident when he says that "In the United States trades unionism is confined for the most part to unskilled laborers." As a matter of fact it is the reverse. Mr. Maxim takes a pessimistic view of the British workman and brings out several illustrations to support him in statements of their arrogance. There is, however, something to be said on the other side, and we feel that Mr. Maxim has not verified the correctness of all his claims.

Machines for Making Cores.

Of late several items have appeared in THE FOUNDRY and its contemporaries concerning German foundry practice and especially relating to the making of cores, by an adjustable machine.

On the surface it would appear to indicate that American foundries are not "up to snuff" like their Teuton competitors, but when we look closer at the question it will be found that the reason we have no machines for making stock cores, is be-

cause we have no use for these. A few years ago, whenever a straight core of any kind was wanted the molder used to caliper his pattern, procure a file and an old piece of a saw and betake himself to the core bench, where he would file out such cores as he wanted. To-day every pattern is furnished with core boxes of its own, at least it is in shops making any pretensions to economical production. The cores come from the coremakers' hand ready to be set in the mold, and fit like two and two make four.

We have discarded stock cores because the making and using of these was saving at the wrong end. The time occupied by the molder in calipering, filing and fitting the cores for a mold has often cost more than the price of making the core-box, besides leaving that chance for inaccuracy so apparent in all cut and try methods. It costs less to make a set of core-boxes for the average pattern than it does to fit the cores out of the stock pile. Adjustable machines for making cores have the same knack of consuming more time in adjusting than they save in making boxes. Adjustability is nice enough in some places, but in core making there is nothing like having things made to order. It pays there to have things, so they will fit without argument, persuasive or muscular. We may be behind in some respects, but certainly not because we have done away with that old time eater, the stock core.

Everything is Right in Its Proper Place.

Albany, N. Y., Oct. 2.—The morning after the holding of the Socialist Labor Party convention in this city a scene was seen that may any day be expected to be seen throughout the land. Then the various organizations of the working class will at least have found their common bottom, and, thus solidified, will sweep like an avalanche down upon the capitalist class and wipe it out at its stronghold, the ballot box.

On that morning, the molders employed by the Littlefield Stove Co., nearly all of whom, from the foreman down, have, through the persistent agitation of Comrade Alexander, become imbued with the spirit of Socialism, gathered together in the molding shop, formed a line, and, with a "flask bottom" painted red, for a banner, paraded through the foundry, out into the yards, around the buildings, down to the office encircling that, and, cheering for the S. L. P. with all the strength of their lungs, then back to the molding shop again, where some "flasks" were filled up and stump speeches made till old "Dinny" Littlefield (the head of the concern) became nearly frantic, and in that kind, gentle a la Carnegie capital-and-labor-are-twins style, so characteristic of all fleecers of labor, roared out at the clerks, the foreman, and every one he dared go near (what fear the capitalists have whenever their wage slaves give evidence of solidarity. How they tremble!): "What's the matter with those damned hounds? Are they crazy? Why the devil don't they go to work?" Yes, why don't they? Crazy? Of course they are! Nice capitalist.

But never mind! They are regaining their senses fast, and, are going to work with a will—work with the S. L. P. to abolish you, Mr. Littlefield, and your class, the whole crew of labor skinners.

(Bravo! shouts "The People," a literary creation of Greater New York, in the headlines accompanying this item. What there is in this notice to inspire a reverence of bravery is somewhat indefinite to us. We can see that certain molders in Albany have been inoculated with a virus guaranteed to make an ass out of a man, but some people become afflicted that way every day of the year without securing any great amount of advertising therefrom, or being hailed as heroes by their fellow-men.

THE FOUNDRY has always insisted upon the right of workingmen to organize as a perusal of past issues will show. We admit their perfect right to affiliate themselves with the Socialistic Labor Party or any other party, their right to parade, make speeches or anything else consistent with our laws. But we do deny their right to use a workshop for that purpose and "The People" would not itself tolerate the same antics in its own publication office. When men enter a workshop their mission is not to paint "flask bottoms" red, or to fill up flasks from which to make stump speeches. There are plenty of vacant lots and halls that can be engaged for that purpose.

"The People" carries on the pleasant job of widening the space between employer and employes as much as possible and we are sorry to see some of our fellow craftsmen become so imbued with Socialism or lunacy as to forget to act like gentlemen. We do not know how expert Mr. Littlefield is as a "labor skinner," but common sense tells us that he has every reason to object to having his flask bottoms made into socialistic banners and his works turned into a campaign quarter. If he has got a set of molders who cannot tend to business during business hours we should advise him to make a change for others, who know enough to do a thing in its right place.—Ed.)

Not as Modern as it Could Be.

One of our exchanges lately described the plant of a well-known manufacturing concern, calling attention to the fine, well lighted buildings, the improved machinery, etc. The most prominent object in the illustration of the foundry is a large, burnt out, wooden flask, with about a hundred gaglers extending above the bars. Other wooden flasks in varying degrees of debility are to be seen in the distance. Our contemporary refers to this plant as being "modern," but in view of the fact that this concern is engaged in manufacturing specialties, where special flasks should be the rule instead of the exception, we cannot agree with him. The building has a first-class appearance, but the interior equipment shows itself to be very much out of date, and anything but modern. The paper in question falls into the common error of calling a plant modern because it is provided with nice buildings. What counts in the cost of production is something else, something to do with, and in that the illustration shows this foundry to be sadly deficient.

Krank's Korner.

When Dr. Moldenke tells us in the September Foundry, in speaking of chemical analysis that some of his determinations have represented three thousand tons of stacked up iron, it appears to me as if he must have been very fortunate in obtaining iron of such a uniform composition as to allow this. If the iron delivered to our foundries was fairly uniform there would be but little need of a test, either physical or chemical. Mr. Wm. B. Phillips said in a recent article appearing in the Iron Trade Review on the "Composition of Southern Irons," that he had known cases where 40 per cent of the iron graded as No. 3 F carried more than 2.50 per cent of silicon and 16.5 per cent of it carried more than 3.0 per cent. The author quotes further examples of irregular grading and in view of these statements it puzzles me to see how Dr. Moldenke could get along with such few determinations if his iron was bought without specifications as to composition. Surely no system, allowing so great a latitude, could keep close enough to actual requirements to become economical.

* * *

Our friend Putnam said in a recent article that "pure iron is the desideratum." If Brother Putnam will procure some wrought iron he will have one of the purest forms of iron, and if he will attempt to melt it and try to make castings therefrom he will find that pure iron is not such a "desideratum" as he would have us believe.

What we are pleased to term the impurities in iron, are simply elements, through the regulation of which we produce castings of different characteristics. Without these impurities we should simply have a mass of uniform appearance and we would be unable to turn out castings of a varying degree of hardness. The founder is called upon to furnish castings having variable qualities and without impurities it would be impossible for him to do so.

* * *

The earlier forms of molding machines, commonly known as "squeezers," sought principally to relieve the molder of the labor in ramming. With plain castings this operation probably occupies the greater part of the molder's time but as we turn to more complicated patterns, the chief time taking is found in drawing the patterns and in such cases an arrangement facilitating this, becomes the principal feature to be sought after in a molding machine. Some objections are advanced against the cost of stripping plates, but in such castings as gears, an accurate mold cannot be made without them, and the most perfect arrangement that can

be made is in the end the cheapest. Several types of machines have been placed on the market, calculated to take ordinary patterns without any special preparation. The intention of their makers is beautiful, but they all forget, that if it pays to get up a machine at all it pays to get it up right. The adjustable feature sounds all right on paper but its usefulness is limited when it comes to bringing it into practice.

* * *

A writer recently characterized the utilization of chemistry in the foundry as a fad and intimates that a physical test is universally to be preferred. If the writer was familiar with a number of foundries he would find that a large proportion of these regard all kinds of tests as fads. Furthermore, half of those who claim to make a physical test, go at it in such a slip-shod manner as to render the results of but little value.

Everything can be made a fad by being carried too far. Chemistry can be made a hobby but the fact remains that there is a large field of usefulness for both it and physical tests. The man who would insist that green sand molding was suitable for all castings would idolize his own opinion beyond what facts would warrant. The same opinion held in regard to the legitimacy of either test would be equally absurd. For ordinary castings, chemistry may be superfluous, but when we come to the higher grade of castings, about the composition of which, something is desired to be known in advance, it certainly fills a want, as is shown by the increasing use of chemistry. Malleable and steel foundries would be peculiarly situated without chemical analysis, and there is a question whether cast iron is not affected by metalloids which the physical test fails to record. In any event there is plenty of room for both, and neither will become a fad unless the one who adopts it feels so inclined.

The same writer alludes to chemistry as being out of the public mind just like the center blast. In this connection it should be noted that improvements generally take a long while to be perfected. The bicycle used to be considered a fad, and it was several decades before it met with public favor. It took several years after Fulton's experiment on the Hudson river to bring steam navigation to a commercial success. There are obstacles in the way of introducing the center blast at the present time, chief of which is the extra care with which the tuyere must be prepared, and the chances it offers of being made inoperative. None of these difficulties can be said to be unsurmountable, however, and as greater objections have been overcome there is no reason why a premature opinion on the subject should carry any special weight.

There are a great many things around a foundry, besides iron, that cannot be measured by a physical test and instead of decrying the merits of either method, we believe in encouraging the use of both. Success has been achieved with either, and there is no reason why any partiality should be shown at this stage. Men and systems, and not systems alone, are what determine the value of each.

* * *

In the paper on "Physical Tests," read by Mr. Knight at the Cincinnati convention of the Western Foundrymen's Association, the author makes some calculations tending to show that if a foundry made a 24-foot flanged cylinder, and was guided in doing so by a physical test, there would be a danger of losing the casting, and further that if this were kept up for a year the loss would be $3,100, enough, the author says, to keep a chemist in opulence.

Mr. Knight could easy extend such statements until he proved that every foundryman employing a chemist was sure of becoming a millionaire. The only fault to be found with Mr. Knight's basis for wealth is that it does not exist. No foundry is going to lose a 24-foot cylinder every day for a year just in order to show that it would have been $3,100 ahead by hiring a chemist and goodness knows how much by leaving the job alone. Mr. Knight figures out, that according to a certain test bar which he analyzed, the shrinkage in iron may in this case have varied half an inch in the 24-foot length of the cylinder. It may be true what he says about this increased shrinkage, but there is just this much about the loss of the casting on this account: The molder who should construct a mold for this casting in such a manner that this half-inch of shrink-

age was not provided for in 24 feet, would receive the impression that he was not wanted in short order.

Probably Mr. Knight would blame the absence of a chemist if the flanges shrinked off. I would blame the molder. Chemistry has its place, and I am willing to acknowledge its usefulness, but I believe there are sufficient facts on hand on which to base its worth without bringing in mere suppositions, which could never take place in practice.

* * *

The excellent paper of Mr. Truesdale on "Molding Sand," which was read at the same meeting, may cause some of our foundrymen to bestow more care upon the selection of suitable sand. The author's experience with the use of silica sand for cores is corroborated by others, though he neglected to state one phase of the question. Silica sand reaches its greatest utility in small and complicated cores, where but few claims can be made in excess of its excellence. When it comes to larger cores, however, it does not have sufficient adhesiveness to support itself. This is mentioned just because some people may want to carry a good thing too far.

Notes on Malleable Iron.

By W. H. KANE.

The small amount of literature which has appeared upon this subject has largely been confined to a few generalities, leaving the reader but little information of any practical value. Much of the practice connected with this branch of the foundry business has been guarded in secret and even those who professed their intention of describing it, have in the majority of cases held back the more important parts of the trade. The manufacturers of malleable castings used to keep the strictest secrecy about the mixtures employed in producing good castings, and even their best friends were denied the privilege of knowing anything thereof. As it is, it hurts the old timers to see anything in print pertaining to the subject, which undoubtedly appears to them as violating sacred promises, but, thanks to chemistry, we are becoming better informed than the old school of manufacturers themselves, and are enabled to account for phenomenas in a more intelligent manner than they ever thought possible.

At present there are in the United States eighty-two malleable iron works, melting from five to one hundred and thirty tons of iron per day each. The greatest part of the output is confined to carriage and hardware specialties and agricultural and railroad work. Some years ago when charcoal iron constituted the bulk of the iron employed and the manufacturer had not yet learned to utilize the cheaper coke irons, malleable iron was mixed according to grade, and as there was less exactness than we find today, it was a comparatively easy matter, especially where an intelligent melter was employed, on whom reliance was placed.

The mixtures employed for light work at that time were made to average the grade of from 3¼ to 3½, those for agricultural work from 3½ to 3¾, and the mixture for couplers or other railroad work was graded so as to correspond to a No. 4 iron. As tending to show the practice in those days I append a description of a heat, which was mixed and melted by a friend of mine, who was very enthusiastic over the favorable results obtained:

7,000 lbs.	Sprues	averaging	No. 5	iron.
1,000 lbs.	Elk Rapids	"	" 2	"
1,000 lbs.	Elk Rapids	"	" 3	"
2,000 lbs.	Antrim	"	" 2	"
1,000 lbs.	Hinkle	"	" 2	"
1,000 lbs.	Union	"	" 3	"

13,000 lbs. averaging a grade of 3.76.

In those days no attention was paid to the silicon or manganese contained in the iron. For light castings the iron should be higher in silicon, as this increases the fluidity; the average percentage of this metalloid in a mixture calculated for that class of work should be at least one per cent which, together with from .35 to .40 per cent of manganese, will give, if properly annealed, a tensile strength of from 39,000 to 44,000 pounds per square inch and an elongation from 4 to 7 per cent. For couplers and heavy work the amount of silicon in the mixture should average three-quarters of one per cent (.75) and manganese about one-half of one per cent (.50). The following tests from a number of heats, besides giving

the tensile strength and elongation, also show the amount of silicon and manganese as found in the mixture before melting and the amount of these metalloids found in the casting before annealing:

Heat.	Per cent of Silicon in Mixture.	Per cent of Silicon in Casting.	Per cent of Manganese in Mixture.	Per cent of Manganese in Casting.	Tensile strength pounds.	Elongation per cent.
A	.98	.59	.52	.19	49,547	6.83
B	.92	.54	.49	.24	49,637	6.33
C	.97	.57	.49	.22	47,885	7.16
D	1.00	.78	.48	.35	44,649	5.50
E	.99	.58	.57	.19	49,700	8.16
F	.90	.59	.57	.38	49,849	8.33
G	.78	.52	.58	.31	50,060	6.16
H	.79	.53	.64	.48	52,460	4.50

The average amount of iron melted at these heats was from seven to eight tons and the mixture, made expressly for heavy work, consisted of 40 per cent Sprues, 40 per cent of coke irons, 15 per cent charcoal iron and 5 per cent of malleable scrap, and made very fine malleable castings. The cost of these varies greatly, as economical production depends largely upon successful manipulation of the foundry, where I have seen the cost of labor alone vary from twenty to forty dollars per ton of output. At the present time there is nothing to prevent malleable iron being made according to specifications, although the same mixture will not work the same in the furnace on all occasions.

The iron should be puddled as soon as it starts to melt, say an hour and a half after charging, and every fifteen minutes thereafter. A furnace of eight tons capacity, working well, should be ready to skim in two and a half hours after charging.

Some foundries only skim the metal once, while most of them prefer to skim it twice, and I think this is the most practical. After being skimmed the last time, the iron should be given enough time (say from ten to twenty minutes) to regain its heat before being tested. As soon as the test shows the carbon in the iron to be in the combined state (white iron) the metal should be tapped, providing it is hot enough. If it takes more than twenty-five minutes to empty the furnace, care should be taken to shut off the blast from the top tuyeres, as the blast will tend to reduce the percentage of silicon and manganese in the iron after the carbon is combined. A large sprue should be poured, when the furnace is half empty, and after being sand cooled should be used as a test piece to determine the amount of graphitic carbon present. For heavy work, a sprue two inches in diameter makes a reliable test piece; for light work a smaller one should be used.

The annealing and other operations connected with the production of malleable castings vary but little in the different works. A few have annealing furnaces in operation where neither pots nor packing is employed, though this method causes the casting to scale from contact with the air. Such works generally confine their operations to turning out castings for their own use, and do not need to be so particular about appearances as they would if placing their product on the market. The rapid growth of the use of malleable castings in car construction has been brought about principally through a constant reduction of their selling price. The great difference in cost between gray and malleable iron castings has disappeared, being at the present about one and a quarter cents per pound, though when it is considered that a casting made of gray iron may be reduced as much as sixty per cent in weight, if made of malleable iron, this difference quite disappears when the net cost is considered.

The prices obtained for malleable iron castings have been greatly reduced during the past three years. This is to a certain extent due to improved facilities cheapening the cost of production, while it is also true that the manufacturer's profit has been scaled down so low that but little remains on which to base a further reduction of cost, without sacrificing all profit. As every advantage is taken in the purchasing of material, and as the wages paid has reached a plane where further reduction is considered impossible, and likewise there can be but little hope of any great improvement in foundry facilities, while the cost of selling is increasing owing to competition, there is a danger the quality will be sacrificed in the attempt to lower the selling price of these castings. Rough molded castings full of

blow and shrink holes, the last the most important defect to be guarded against in the manufacture of malleable castings, as well as poorly annealed and badly bent or twisted out of shape castings, may be produced for less money, but the purchaser will in the end be the loser. Good malleable castings never have been and never will be produced as cheaply as gray iron.

In connection with the low prices at which malleable iron is sold, it is strange that the demand actually exceeds the supply. Most of the malleable iron works, which have come under my notice, are at the present writing a month behind orders. While a raise in the price of raw material may advance the cost of malleable castings, it is also a fact that several of the chief manufacturers have contracted for a large amount of work at present prices.

The Doherty Process.

By S. S. KNIGHT.

Having been asked to review the various articles that have appeared in the trade journals from time to time concerning the above process, and having done some actual work upon the same, it is with a most positive assurance that nothing but truth will stand investigation that I attempt to point out some of the virtues and to denounce the absurd claims made by many writers upon this subject whom I am sure have never more than seen a cupola, and are totally ignorant of its operation.

The claims made for this process may be, for convenience, treated under two heads—first, those pertaining to a more economical operation of the cupola furnace; second, those that pertain to the amelioration of the quality of the metal.

Under the first head we will note the saving in the amount of fuel used which is one of the alleged main features of this process. I here will quote from an article which appeared in the November Foundry: "A saving in quantity of fuel used is effected as the hydrogen flame is 4.28 times as hot as the ordinary carbon flame; and as oxygen is a strong supporter of combustion the gases obtained from the decomposed water, play an important part in melting the iron placed in the cupola, thus effecting a saving in the quantity of fuel required to melt the iron. For the same reason an inferior grade of fuel may be used."

A few observations upon this claim will no doubt prove at least that the wording is misleading. In stating that the complete combustion of hydrogen with oxygen developed 4.28 times the quantity of heat that the burning of the same amount of carbon to anhydrous carbonic acid would, only partly tells the story. It must be remembered that heat is but a form of energy and is directly dependent upon molecular motion; and since energy is uncreatable and indestructible, the amount of heat produced must be proportionate to the amount of work done.

The vapor of water or steam must be raised from its initial temperature of 212° Fahr. to nearly 3,000° Fahr. before disassociation takes place.

Water being a chemical compound, heat is required to overcome the mutual affinity of the hydrogen and oxygen and hence although over 60,000 heat units of the British engineering system are generated by the combustion of one pound of hydrogen to water, yet the same amount of heat is required to overcome the affinity of the component elements and hence no thermal advantage is gained.

Even supposing such were not the case, it must be remembered that all of the liberated hydrogen does not combine with oxygen to form water, but since so many other active chemical elements are present at so high a temperature part of this element (hydrogen) is combined into hydro-carbons such as methane, etc., while part combines with nitrogen to form ammonium compounds.

In the case of melting with carbon in an air-blast, two simple elements are brought together and combined, the resulting heat being used in melting the charge of iron. On consideration, therefore, it hardly seems possible that the figures given could have been used for any other purpose than to create a false impression in favor of this process.

Such methods of advertising are too contemptible and mean to spend time reviewing.

In speaking of the possible complete oxidization of all of the disassociated hydrogen to water it may be of interest to know that even with carbon alone it is but partly oxidized to anhydrous carbonic oxide and part

passes out of the stock as hydro-carbon gas.

This is still further evidence of the invalidity of the claims cited since with carbon no disassociation takes place and therefore no heat is rendered latent from this cause.

Another quotation contains the paragraph. "Another reason assigned for use of an inferior grade of fuel is, that the impurities contained in such inferior coke or coal are burned out by the intense hydrogen flame, so that they do not enter into the iron to injure it."

Just how hydrogen is going to eliminate sulphur and phosphorus is somewhat deeper than Bresilius or Blair ever investigated the subject. Such an assertion is ridiculous since although the presence of strong reducing agents may affect the physical structure of the metal they will not in the presence of a strong oxygen reaction, such as is ever present in a cupola, decidedly change its composition as concerns these two metalloids. Even at the high temperature of the open hearth furnace, the elimination takes place only after some time and then only through the intervention of the basic slag, which is wholly wanting in the cupola.

The same reasoning also applies to another claim that reads thus: "The hydrogen flame and intense heat produced by it, and the effect of the liberated oxygen destroy the impurities contained in the lower grade of iron, so that the iron is left comparatively pure after being melted in and by these gases. As a result the foundryman may use a lower grade of iron than would otherwise be adapted to his purpose."

The fact of the matter is that the whole process seems to be interpreted amiss by its promulgators. There can be no doubt that the metal attains a much higher heat when this process is used, and since the solubility of carbon in iron varies as the temperature of the solvent, a larger percentage of carbon is carried in iron melted by this process; and hence the reason why lower grades of metal can be used. This main feature seems to be totally unknown to the Doherty Process Company, or to the inventor himself, and is the one great point upon which the utility of the scheme depends.

It seems strange that if Mr. Doherty is the inventor of this process, as he claims to be, that he should be so absolutely ignorant of the reactions which takes place in its operation.

We come now to another claim that reads as follows: "Again, in melting iron there is ordinarily great loss, and particularly so in the use of scrap, from the fact that rust (oxide of iron) passes off in the slag. Iron rust is, practically, iron going back to the ore state and the heat of the ordinary cupola cannot resmelt this oxide of iron. By the aid of the hydrogen flame and the liberated oxygen, this iron rust is resmelted, converting it into pure iron, so that the loss is reduced to a minimum. Foundrymen often have detected a loss of 30 per cent in melting rusty scrap iron, whereas by the Doherty Process it is claimed that the loss is reduced to less than 2 per cent." After reading the last quotation it would be hard to believe that the author of it possessed the powers of reason or even was able to imagine that a foundry was operated for any other purpose than to lose money. In a shop melting 400 tons per day the loss per day would be equal to 120 tons or at $10 per ton $1,200 per day. If these conditions held in practice surely foundrymen would be in business for glory only.

If an analysis of cupola slag has ever been made that showed more than 4 per cent of iron—the author does not know of it. On the other hand he has made hundreds of such analyses that showed no more than 2.5 per cent of iron. However, there is no doubt that a reduction of iron oxide does take place under this process and slag taken while this method is in operation should not show more than 1.5 per cent of iron.

It certainly is to be regretted that so excellent a process ever fell into the management of so inexperienced and irresponsible men. By making such absurd claims its promulgators are greatly injuring its chances among capitalists and business men rather than doing it any good.

Another paragraph reads thus: "It is a laudable ambition on the part of every foundryman to be able to produce smooth and perfect castings, no matter for what purpose they are intended; but not all are successful; neither is it an easy matter to obtain perfect castings where delicate patterns are to be wrought, without using a high grade of iron.

"By the use of the hydrogen flame the iron is rendered very hot and homogeneous, so that all castings come out in perfect condi-

tion, being very smooth and even. Those who have used this process state that it is exceedingly rare to lose a casting, no matter how ponderous or how delicate it may be."

It must be confessed that it is very difficult for a practical foundryman to see how the injection of steam into the air blast can produce a homogeneous metal. It is also hard for the uninitiated to understand just how the use of this process could make a good casting in a bad mold, but such is what we are told.

In conclusion, let us consider one other claim, which reads as follows: "Where machine work is required, it seems to be the usual practice to make the mixtures of the softest irons possible in order to reduce the expense of working in the machine shop. This necessitates the use of high grade irons, or lower grades which may give softness, but which are apt to render the iron weak. Even then a 'scale' or hard surface is formed, which it is difficult to work through. As the hydrogen flame burns out the sulphur and other impurities contained in the iron, the casting is rendered very soft and easily worked, even though a portion of the graphite carbon has been converted into combined carbon, thus rendering the casting much stronger than it otherwise would have been.

The increased tensile strength of the castings produced and their semi-malleability is one of the most remarkable features incident to Mr. Doherty's process of melting. In England, where iron and coke are inferior to the grades used in this country, the tensile strength has been increased as high as 38 per cent. In this country it is a common thing to be able to increase the tensile strength 25 per cent, although the castings are, as above stated, always soft owing to the fact that the impurities have been burned away. Ordinary stove plates can be punched cold with inch holes not more than one-eighth inch apart, and an ordinary test bar may be put in a vise and upset cold to an extent of 25 per cent of its diameter. These latter tests have been made repeatedly on iron produced from 70 per cent common scrap and 30 per cent No. 2 and 3 foundry pig."

Metallurgical science should feel most deeply indebted to Mr. Arnold for the facts which he has given to the world and most of all for telling poor benighted foundrymen that the greater the iron constituent of a metal, the softer it will be.

I believe, however, that most foundrymen would advise him to spend his spare time somewhere in the neighborhood of a foundry before he again startles the foundry world with another choice lot of his foundry-fiction and humor.

H 2 O.

By TOM BOWERS.

If any of our foundries are experiencing difficulty in melting during dry weather, they are certainly in such a semi-conscious condition as not to be able to realize their predicament. Day after day, rain or shine, they are melting iron with the same amount of fuel, and the foreman who should have the audacity to blame the weather for a bull heat would likely find his employer planting the impression of his boot on the former's anatomy. It would be quite a joke on us if we should charge up a cupola during a thunderstorm, according to a wet weather formula, and by the time we got ready to put on the wind, find the clouds blow away and leaving us without enough atmospheric assistance to get the iron out of the cupola.

Mr. N. T. Arnold, in writing of the Doherty process in last month's FOUNDRY, forgets that we have in all mechanical operations a factor of safety. This is present in the melting of iron also, and the man who is running his cupola at such a close ratio of fuel as to be affected by atmospheric changes, is operating without a factor of safety. At the end of the year it will have cost him more to make his savings than they are worth. I have never seen any difference in melting whether a wet sheet was placed in close proximity to the fan or not, in fact, it seems to me as if the fan would derive its supply of air from any other source except through the sheet, for the air would certainly not flow through the wet sheet, when it is so much easier for it to go around. However, I know of several metallurgical processes that are not operating at the present time because a wet blanket was placed on them.

My reason for placing the sign, H 2 O, at the head of this article is because I do not know what it means, and I always like to show my ignorance where people can get a chance to see it and correct me. The only consolation it leaves me is that a whole lot of people are getting along well in the foundry business, and they do not know a word of Latin or anything about chemistry either. It always seemed to me anyhow that things could be stated in plain language at a smaller cost.

Coming back to water, its elements, hydrogen and oxygen, and its decomposition into its component gases, I want to ask Mr. Arnold a very plain question: If he can perceptibly increase the heat units of fuel by the injection of steam in the cupola, what is to hinder him from burning steam under our locomotives and fires of all descriptions? It seems to me that, as far as fuel saving is concerned, he has started in the narrowest field possible, the proportion of fuel used in the cupola to that consumed at large being very small. If steam will save fuel in one fire it should do the same in another and I believe the railroad managers are as anxious to decrease their fuel bills as ever was a foundryman.

Is it not a fact that as many heat units are required to convert steam into hydrogen gas, as this gas contains? From Mr. Arnold's article one would suppose that whatever steam was injected could have its elements separated and be changed into a combustible material without any expenditure of energy. He would ask us to believe that the hydrogen gas burned in the cupola was a clear gain. We cannot produce something for nothing and I should like Mr. Arnold to tell us of the cost of the hydrogen gas furnished to the cupola by Mr. Doherty's arrangement. As we know approximately the cost of a certain number of heat units in coke it would be interesting to have him give us the cost of a certain number of heat units of hydrogen gas, as made by the above-named system.

Before we can be expected to confidently accept the statement that "a saving of fuel is effected" because "the hydrogen flame is" hotter than the carbon flame, it will be necessary for us to know its cost. There can be no saving unless the number of heat units contained in the hydrogen gas cost less than an equal number of heat units contained in coke. Melting of iron is accomplished at the expense of so many heat units and I fail to see whereby an inferior grade of fuel having a less number of heat units can be adopted economically.

Whether Mr. Arnold is a foundryman or not, one thing is apparent, he does not understand the peculiarities of cast iron, whereby we are enabled to adapt it to many different requirements. He claims that with the Doherty process a cheaper grade of iron may be used because "the hydrogen flame and the effect of the liberated oxygen destroy its impurities." If the intense heat of the hydrogen flame will destroy the sulphur contents of the iron, will it not also destroy the silicon? Mr. Arnold labors under the misapprehension that pure iron is wanted, something a little consideration on his part to the uses to which cast iron is put, will dispel. What he terms the lower grades of iron, are already the purest, being deficient in silicon, carbon and other elements.

We are told that there is ordinarily great loss in melting, from the fact that rust or oxide of iron passes off in the slag, often as much as 30 per cent. How would Mr. Arnold proceed to figure up a heat if he expected to lose up to that amount? I should hate to have him figure up a heat in my shop on that principle. I could guess closer and have less iron left.

Again, we are furnished the cheerful information that "the hydrogen flame and liberated oxygen will convert the rust into pure iron." I don't believe Mr. Arnold intends to pose before the foundrymen of America as a humorist, but this statement is enough to cause a billygoat to smile. Just to convince Mr. Arnold that he is not a transmutor of metals, nor a real conjuror, I would ask him to take a ton of rust, nothing else in the shape of iron, and charge up his cupola. Then let him turn on the intense heat of the hydrogen flame and all the powers of the liberated oxygen and then I want him to tell me how many pounds of iron he taps out.

Surely Mr. Arnold does not mean to claim that he can convert steam into iron and yet that is what his words say. Oxide of iron is not iron and if steam converts it into iron it must supply the missing ele-

ments. When Mr. Arnold says that all castings made by the Doherty process come out smooth, he asks us to believe that iron melted by that method is smoother than if melted by any other method. He asks us to believe that the Doherty process flattens out the molecules, so to speak, and makes up for poor molding materials. I have been knocking myself on the head for half an hour trying to see how the hydrogen flame could in any manner make a smooth casting in a rough mold and I give it up. It also appears as if the Doherty process of melting overcomes core blowing for Mr. Arnold states that a casting is seldom lost, no matter how intricate it is.

Punching stove plate and twisting test bars is an old trick and if Mr. Arnold will look through THE FOUNDRY of a couple of years ago, he will find several examples of that art. I should like to have Mr. Arnold furnish me with the names of half a dozen reliable founders in the United States who are using the Doherty process and ready to testify to its merit. As a foundryman I am willing to convince myself of anything not conflicting with common sense, but I have yet to see the first instance where something was obtained for nothing.

Speaking of the purifying effects of the hydrogen flame reminds me that blast furnaces ought to be willing to adopt it, and then the foundries would have less cause to complain. Why not make the iron right in the first place, Mr. Arnold, instead of leaving the task of purifying it to the foundry? I believe the Doherty process starts at the wrong end. If it is economy to burn steam in the cupola it must also be so in other places. When the time comes that I can see a locomotive generate steam with steam, when hydrogen gas is demonstrated to be a cheaper fuel for cupolas than coke, then I will be ready to adopt it. Mr. Arnold might tell us the cost of melting iron by the Doherty process and then we could form some opinion of its economy. His paper contains nothing but a few generalities and a whole lot of claims without any proof to substantiate them.

Let him offer the scientific explanation of the phenomenon, which others failed to secure. Let us have the analysis of iron so that we may judge of its properties. There is nothing to be gained by keeping such things in the dark, and Mr. Arnold will find that a ready explanation of the Doherty process will offer the speediest way of securing its introduction.

A Notable Casting.

The modern guns, of large caliber, using high explosives, have invariably been built up, instead of cast in one piece. Experiments are now being made with guns cast in one piece, and one of these castings, made

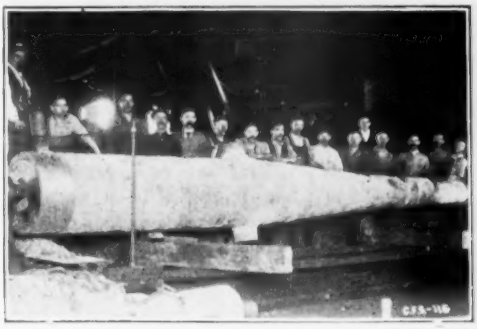


FIG. 1.

by the Otis Steel Co., Cleveland, Ohio, is illustrated in Fig. 1. Its length as cast is 32 ft., weight about 60,000 lbs. When finished, the length will be reduced to 23 feet. The bore will be eight inches in diameter.

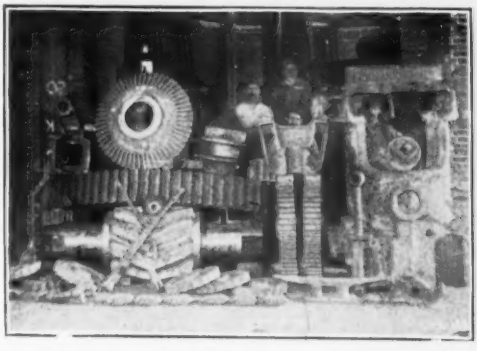


FIG. 2.

The variety of castings turned out by this company may be judged from Fig. 2. Our third illustration shows a bottom for a Bessemer converter, which in most cases is built up of angle plates and castings, but in the present instance it is cast in one piece. Its weight is about 6,000 lbs. All castings

turned out by this company are made by the acid process. The illustrations, originally prepared by the Railway and Engineering Review, show the wonderful progress which has been made in steel founding within comparatively few years.

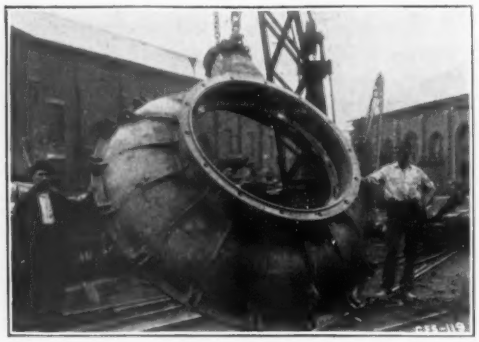


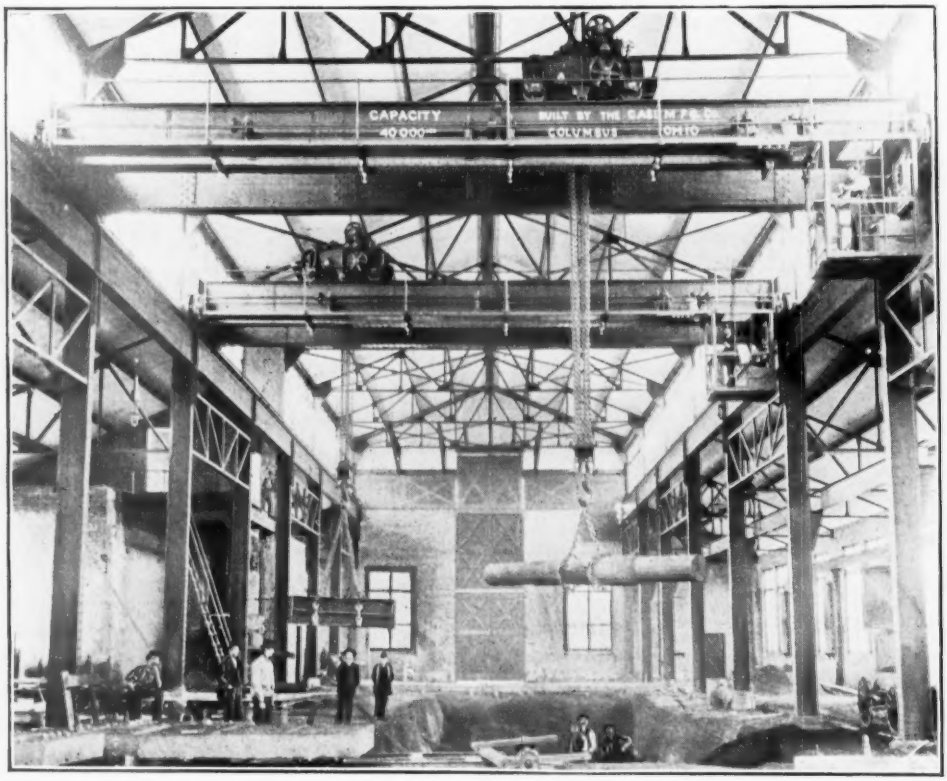
FIG. 3

Some Electric Cranes.

It is no exaggeration to say that during the past ten years the development and subsequent introduction of electrical machinery in connection with almost every line of manufacturing industry has done more to reduce the cost of production than any other agency.

In no line has this been more conspicuous than in the operation of machinery for the handling of the product of our large mills and factories. Prominent among such machinery stands the three-motor overhead traveling crane. Without its efficiency the mammoth proportions of our iron and steel foundries and kindred plants would be impossible. Everything in the way of improvements in this valuable device can not fail to be of interest to all those requiring such machinery.

The accompanying illustration shows two three-motor overhead traveling cranes of



TWO TWENTY-TON ELECTRIC TRAVELING CRANES BUILT BY THE CASE MANUFACTURING COMPANY, COLUMBUS, OHIO.

40,000 pounds capacity each, as recently installed in the large foundry of C. & G. Cooper, Mt. Vernon, Ohio. There are several new and important features entitling them to the notice of manufacturers. The first to attract the eye of the observer is the form of the girders, they being parallel and of even breadth throughout their entire length. This form is said to be scientifically correct by the makers and more free from vibration, the feature often so destructive in other forms of crane girders.

In many instances where they have been tested to double their rated lifting capacity they show practically no deflection. A thorough inspection can not fail to disclose to the practical mind the rigid character of the connection of the main girders with the end truck frames which makes it impossible for the girders to get out of square with the wheel base. The material throughout is distributed so as to procure the maximum strength with the minimum of material, and its simplicity of arrangement renders the labor cost the lowest possible.

Among other striking and valuable features in these cranes is the entirely new and novel arrangement in the hoisting gear invented by W. H. Thompson, for which patents have been recently allowed.

In this very simple and efficient arrangement the lifting load is made available automatically to procure a braking action which prevents the load reversing or backing down the hoisting gear under any condition, no brake to hold the load being necessary.

A comparatively feeble magnetic brake is used in connection with the hoisting gear only for the purpose of resisting the momentum of the motor when the current is shut off.

A substantial foot-way extends along the whole length of the bridge and enables the operator to have easy access to every part of the machinery. This does not admit of any excuse for any detail being neglected in the matter of lubrication or proper care, cleaning, etc.

The bridge propelling motor, it will be observed, is located on the side of the bridge directly over the operator's stand; this location being the most favorable for the operator to give it prompt attention and proper care. For foundries especially the location is more favorable as it exposes the motor to the least heat from the foundry floor and it is further so arranged that the motor in whole or in part can be removed without displacing any other part of the machinery.

The operator's cage is very substantial and constructed conveniently large.

The arrangement of the speed controller's switch-board outfit, wiring and trolley connections may justly challenge comparison.

The hoisting gear is of the double drum type; each chain drum is spiral-grooved, right and left, the chain winding from each end of the drum at the same time toward the center. In every position of the hoisting block the chains of each drum are at the same relative angle, leaving no tendency to twist the block in hoisting or lowering the load.

The gearing of the hoisting trolley is very substantial, all machine cut. Every important journal, where dispatch in making repairs is necessary, is fitted with changeable bronze bearings removeable with the least possible labor, which admits of worn bearings being repaired in a few minutes.

All shafting is of steel and all material the best that can be obtained for the purpose of securing durability and efficiency.

Each motor is of the enclosed or dust-proof type and especially prepared for crane service and of ample capacity.

The cranes illustrated herewith were built by The Case Manufacturing Company, of Columbus, O., who have furnished us with the data on which this article is based.

Western Foundrymen's Association.

The fall meeting of the Western Foundrymen's Association was called to order at the Grand Hotel, Cincinnati, October 18, the president, C. A. Sercomb, presiding.

At Monday's afternoon session a paper was read by S. S. Knight on "The Value of Physical Tests."*

The paper brought out a lively discussion, participated in by Messrs. Moldenke, West, Johnson, Bell, Moore and others.

Mr. Knight contended that other elements besides silicon exerted an influence upon the shrinkage of iron, and was supported in his views by Messrs. Johnson and West. The melting point of different grades of iron

*Published in THE FOUNDRY for November.

came in for its share of attention, and it seemed to be the general opinion that hard iron required to be heated to a higher degree of temperature than soft iron in order to be in a fit condition to pour. The first tap from the cupola was also considered as being of uncertain composition, though the cause thereof was not positively defined by any of the participants in the debate.

At the Tuesday morning session Thos. D. West read a paper on the "Comparative Fusibility of Foundry Metals,"† being a continuation of a paper read by the author on the same subject before the Pittsburg Foundrymen's Association at their June meeting and published in THE FOUNDRY for August.

During Tuesday afternoon the visitors were given a trolley ride through the suburbs of the city, stopping, by invitation, to inspect the plant of the S. Obermayer Co. In the evening the Cincinnati foundrymen tendered the visitors a banquet at the Grand Hotel.

WEDNESDAY MORNING SESSION.

In the unavoidable absence of D. H. Truesdale the secretary read his paper on "Molding Sand."* A number of very interesting castings were exhibited by Clinton A. Truesdale, illustrating the point made in the paper.

In the discussion which followed Charles A. Bauer said: In our practice no facing is used. Our castings are about of medium weight, and we get a very fair surface without facings. The sand that we use is known as Sandusky sand. We use for our cores almost exclusively silica sand, with very good results.

C. F. McGilvery: Some years ago we used some silica sand. I think it is called Dresden sand. I ordered a car of the sand and thought we would do without the facings, we had trouble with the molders to get them to use it. They were not careful enough. Since that time we have had to use facings. There is no doubt that if you use sand with fine silica you can do without facings and I think make better and sharper castings, but that sand has not got the bond that the ordinary molding sand has. It requires harder ramming and a little more work, and the men object to that. Still I think it makes a better surface on the castings and makes them sharper, possibly because you have to give them a harder ramming. As a rule too much fine sand is used and too little elbow grease. I think there is one of our mistakes in rough castings. You take fine sand and ram it hard and of course it will stand. To make the surface the same on molds it is necessary to ram coarser sand a little harder. That requires more labor, and that means more money.

John D. Sadlier: I, too, have had some little experience with facings and sands of different character, though rather for use with a larger and heavier grade of castings —loam work and dry sand. I believe that I was one of the first users of silica sand as a facing for molding in the country. That was brought about some years ago, when steel was introduced to this country as Bessemer steel. I was employed by the Cambria Iron Company, at Johnstown, for about three years, from 1871 to 1874, in experimenting to get a facing that would stand the steel. We found after a long experiment that silica sand was about the only sand that would give satisfaction. It required a very fine grade of sand, as in the steel the crystals or fibres are very fine. In order to prevent these from penetrating, permeating and entering into the pores in the sand, you have to have it finer than the crystals of the steel. It requires a sand without a great expansion, so that it will stand up against the intense heat at which steel castings are poured. So we found that silica was the best sand to stand that. You can grind it much finer and have an open and porous sand that will prevent the steel from running in it. I found afterwards that the use of silica sand in loam work was a great advantage; taking burned silica, or burned core sand—and using a quantity of it in the loam you get a mixture from which

†A continuation of a paper read by the author before the Pittsburg Foundrymen's Association, June, 1897, and published in the August Foundry. It relates further experiments made by Mr. West in regard to the fusibility of metals, and the effect of metalloids upon the fusing point of iron. The author corroborates most of the conclusions arrived at in his former paper. Owing to the amount of original matter we have on hand we are compelled to leave out this paper and the discussion thereon.—Ed.

*Published in the November FOUNDRY.

you receive wonderful results. I have a simple method for testing sand where you don't have a chance to make chemical analysis, which anyone can use—make up a ball of sand and subject it to a severe fire, similar to what you get when the iron is poured against it, and if the sand browns nicely instead of crumbling away, you can almost be sure that it will stand the iron. We had an instance of that some years ago in making some very large gears. We had trouble getting the teeth. The scales would fall off the mold and you could just brush the teeth right off. I was called to see if I could find out what was the trouble. They had a mold made with the teeth all around under the gear. I took a quantity of waste, saturated it with oil and ran a ring round underneath the teeth. There were no arms to interfere, and there was a good chance to put a ring in front of the teeth. Then I lit a match to it and you could see the teeth slide right off. There was some kind of soft quicksand of clayish nature, and the moment the heat got against it, it didn't seem to dry in the bond; it seemed to slide away. If you take a ball of sand and subject it to the fire and it stands up against a quick fire, you may be sure it will stand the iron, if it is open enough so it will allow the vent to escape. It is a simple, easy test. Anyone can try it and keep governed as to the fineness, according to the work required, where it is dry sand work. In lighter or finer castings you have to be governed by the fineness of the sand to have a nice surface on the castings, and, as I have said, you can determine in a moment by subjecting a ball of sand to a quick fire whether your sand will stand in the mold. If it does that, you can be pretty sure that there is some other reason for not getting good castings.

Mr. Moore: Your experience has been in the nature of bringing up sand which contained a larger amount of bond and a small amount of silica.

Mr. Sadlier: I find that causes more trouble than anything else. Sand certainly requires a certain amount of bond. As much water should be used as possible. Some make a mistake in having sand that is really too close, too strong, and containing too much clay. You must use water enough and ram it hard enough. These things usually cause the loss of more castings than anything else.

H. F. Frohman: I think the gentlemen here have a wrong idea in regard to what we term "facings." We term facings any material which is refractory, that is, which will stand any amount of heat greater than melted iron. The general accepted idea is that anything black is a facing. That is a wrong idea. During the last few years we have been introducing a silica, also used for facing, which stands a greater amount of heat than some of the other black facings, especially on such work as steel, where the iron is poured at a great heat. Regarding silica, if you grind it fine enough it will make a good facing. Silica sand itself will make a good facing if fine enough; but my own idea of a facing is to overcome that defect in sand of which Mr. Truesdale says: "No more alumina or clay should be present than is necessary, as any increase over the proper percentage makes bad, rough work, by its melting and adhering to the casting, causing extra expense in cleaning." As you know, in all parts of the country they have not got the best sand, and it costs too much to bring the best sand to those points, where they might otherwise be used to advantage. Many have not the facilities, nor do they care to invest in sands most suitable to their class of work. We recommend and it is absolutely necessary in such cases to have facings to cover up and protect the sand from melting and adhering to the casting. In regard to the non-use of blackings and facings on certain kind of work, we have seen that this can be done, although looking at it from a business point of view, it might not be the thing for me to say that castings can be produced in that way; but we always claim there is extra expense in so doing—that is, probably more so than with the use of blackings and facings.

C. S. Bell: In our line of business we have tried almost everything. I suppose you are, most of you, familiar with the sand from Sandusky. We have found the sand, which is recommended as suitable to make castings without facings too expensive, costing in some instances as much as $4 a ton, when, on the other hand, we could buy sand which was satisfactory to us at from $1 to $1.25. This sand we could not find anything the

matter with, consequently we have abandoned the higher-priced sand, some of which has a national reputation, and are using a sand which we can get for about five cents per barrel, which we consider a very good sand for our purposes.

Clinton Truesdale: In bringing forth my explanation of castings this morning (referring to castings on exhibition, including bust of ex-President Harrison), I did it for the purpose of carrying out the desires and wishes of my uncle, D. H. Truesdale. I wish to say that I have been associated with him and got my training strictly under his observation for the last twenty years; and I say without fear, and I know some of the gentlemen will bear me out, that I consider him one of the brightest men engaged in modern foundry practice. These castings which I have been showing you are strictly in the line of stove-plate, light castings, and Mr. Truesdale's experience and mine also is confined exclusively to stove shops. In fact, I have no knowledge very far reaching in respect to heavy machinery, or anything of that kind; but we have been giving the subject of silica considerable study for some time, and how well we have succeeded I leave to the gentlemen here, and after they have examined the display I think they will bear me out that we have got along very well. In regard to the facing question, I have succeeded in the past two years in grinding silica sand in ball mills for facings, thereby dispensing with the use of facings. In saying this I am not trying to keep my neighbors from going to the Obermayer Company. I introduce from 33 to 70 per cent of silica sand, according to the grade of work. I conceived the idea of trying to grind it and use it exclusively for facings. I had two ball mills placed in the shop for the purpose of grinding our facings. After awhile I succeeded in introducing it altogether as a facing. I have used a proportion of three-fourths of silica sand and one-fourth Newport sand, found over in Kentucky, our neighboring state. I also found it gave good results in adding to it fire clay when used for cores. I have succeeded in introducing silica sand, a very fine grade, found sixty miles south of Louisville, in the foundries here in the city, where they have never had opportunities to make large cores—among them Erhart & Co. They tell me they have had great results, where heretofore they have lost three or four out of five pieces of castings caused by a bad core, which difficulty they have now overcome. They have dispensed in a great measure with their blacking. Cores made of silica sand will run out of the casting, as D. H. Truesdale says, at the mere tap of a hammer. Castings made with silica sand will not scale as readily as those made with facings, and have a very fine smooth surface.

I have on exhibition this morning some castings showing gates directly on the face of very fine lines; also some gated on a smooth surface. You will see at a glance how it scales and cleans. It is not vitrified or burned off. In fact, in my judgment, there is no end to the use of silica in modern foundry practice.

H. S. Vrooman: All sand contains more or less silica. I can't see wherein silica introduced into sand could make it peel from the casting any more freely. There is only one point—it makes it more porous. If you take the iron, for example, that contains all the carbon up to a point of saturation, you could introduce no more carbon into it and make it hold. If you have a sand that contains a sufficient quantity of silica, the introduction of any more will not do any good. As far as making it more refractory, I can't see how it will do that, either; because the alumina in itself is non-fusible—the silica is non-fusible. I can see, as this gentleman says, a test in trying sand to see whether it will hold up under sudden heat. There is only one thing which that shows, that the sand which comes down very quickly under sudden heat contains a large amount of vegetable matter. The introduction of silica sand will possibly make that percentage of vegetable matter so much smaller in proportion to the amount of sand that it will not show, and, therefore, not come down. And if the sand contains a sufficient amount of silica in the beginning, I don't see wherein this introduction of silica will do any good. If we have to hunt around to find sand that has 60 to 75 per cent of alumina, in order to carry the silica, you could just as well look around for a sand that has a sufficient amount of silica in the beginning without adding it. Now, silica is in two forms, combined and free, in sand. All the sands we

have contain a certain per cent of silica. The variation in the percentage may affect its porosity or refractoriness. The question as to how long sand will wear or stand heat does not depend, in my opinion, upon the amount of silica it contains, nor on the amount of alumina it contains. On the other hand, it depends upon the crystal formation of the sand. Some sands, or crystals, are conductors of heat. Chemistry tells us that alumina, when subjected to red heat, loses its adhesive qualities. So if the sand has been subjected to a red heat, it will no longer contain the water. You may take a fire-clay, supposed to be as refractory as any, make a brick of it and put it in the oven and subject it to a red heat, then take it out and regrind it, and it will never combine with water again; the adhesive quality is gone, because it has been subjected to a red heat. In the sand it is the same, because wherever the face of the mold comes in contact with the molten iron, the face of the mold must become heated to a red heat; and owing to the structure of the crystals, whether it is a conductor or a non-conductor of heat, that red heat penetrates further into your mold. The lines are well defined. If you shake out the mold and take the casting out, you will find a dark-colored line. Seems as though the sand has dried out. In some instances it follows deeper into the mold than in others. If you get a sand of such a crystal formation that it is a non-conductor of heat, then the red heat penetrates further into the mold, owing to its crystalline construction. As to the amount of alumina or the amount of silica which a sand contains, I would advise all to use as open sand as it is possible for them to get, for three reasons: First, that you can work it better; second, you can ram it harder, and third, it will vent easier. There is no question that a sand suitable for any class of work can be found in nature, if the consumer wants to pay for it; and a sand that is strong because of the clay it contains does not make a long-lived sand. Mr. Sadlier can take a sand very high in clay or alumina and test it with his sudden heat and it will stand; at the same time it will not make a good sand for the work.

John G. Sadlier: In reply to the last remark, I would say, that I grant that clay can be subjected to severe heat and still stand it well; but I would suggest that at the same time the sand would have to be judged as to whether it was open and porous enough, in order to allow the vent to escape, and if it did it would stand up to the work and the iron—if it stood the test of a severe fire and the test was similar to the iron running into the mold, something like the iron heating up the surface of the mold very rapidly. If it doesn't stand a severe fire similar to that, it will not stand in practice. I suggested a simple test. I have found some sands that won't do in the molds; they will crumble away. With reference to the use of Sandusky sand, Sandusky county is a wonderful county for limestone. Nearly all Sandusky sand has a great percentage of lime. Some of the sands we use from Sandusky have got more limestone than finer sands, which burn out and forms a quicklime by the heat coming in contact with the limestone in the sand. This will mix in with the iron of the casting, and sometimes produce holes in same, especially if the sand is worked just a little dry. Right in front of the gate, by the heavy body of metal running against it, it will burn, the same as limestone will burn in the kiln. It will burn back for some little distance and give some trouble.

Mr. Moore: Mr. Sadlier, your use of silica has been in bringing up the silica in sands which were deficient. It would be interesting, I think, to those present to know the percentage which you found necessary.

John G. Sadlier: Well, that I would be unable to give, because I have never had any analysis made of any of the sand we use. But that can be very readily determined as to what point you desire to bring it up by actual experience in the shop. You can see just what amount will produce the best results in any one particular case. In one instance, a firm in Chicago was having a great deal of trouble with their loam castings; they would be covered with small light scabs, literally covering the whole surface of the casting. They asked me to look at the work on which these light scabs were not more than one-tenth to one-eighth of an inch in thickness I took some of the burnt sand, which had a good deal of silica in it, and added that to the loam to open it up, and that ended the

trouble there. A great many foundrymen throw out just what they want when they throw out sand that has once been used, under the impression that that sand is burned—in the way of cores, etc., as waste; but a great deal of it is the best thing that foundrymen can have by careful, judicious use of it. Too much of it is not good; but a certain proportion or quantity of it, and in regard to the proportion, you must be governed entirely by the sand which you have. In a new sand you will have to be guided by results from actual experiment in practice.

Charles A. Bauer: I wish to state that we take from 8,000 to 10,000 tons per year of the Sandusky sand, and of all the sands we have yet used have not found any, without exception, that was as free from lime as the Sandusky sand; and I would say that there is only one sand that I have ever known which contains less lime than the Sandusky sand. I want further to say that any one who has ever analyzed any of the Sandusky sand will find that lime is an awful scarce quantity in it.

H. S. Vrooman: I think the presence of iron in sand is evident when you take a sand red in color, such as the Sandusky or Zanesville. It seems to me as though this iron disintegrates in some manner. When such sand lies out in the open air there is a kind of oxidation takes place in that sand and it becomes soft and free, whereas, sand which does not contain considerable iron, under the same circumstances, becomes hard and lumpy and you have got to break it up. In regard to fine sand, I think they carry it to an extreme, try to make too large work with fine sand. Take a sand that is too fine, when you take your pattern from your mold and let it dry, you will find on the surface a very fine quality of sand that adheres to it. If the sand is coarser that will not occur. The sand is too fine in my opinion.

Mr. Moore: I visited a little foundry down in Birmingham, Alabama. It was a very small foundry—very crude. They were making grate bars, manufacturing castings which were good enough, but very rough. I was very much surprised, for from the character of the foundry and the help employed and their lack of ordinary appliances, to note the excellence of their castings. The sand which they use there is of a reddish nature, and presumably because there is a great abundance of iron ore in the country, contains considerable iron. The value of iron in a sand mixture—the question of its value occurred to me then, and I have been very much interested, and hope that some one is able to cast further light upon the question which Mr. Vrooman has raised.

S. S. Knight: I suppose in the last year we have made some two or three hundred analyses of various molding sands throughout the country, from Albany molding sand to as far west as Denver, Colorado, and in the whole catalogue we have scarcely found enough lime in any one molding sand to amount to anything at all, that is, in the sand itself. It is very seldom that lime is found in sand, and when it is there, if the sand has ever been fused, it is in the form of calcium silicate, because calcium being a very active agent, it will naturally combine with silica di-oxide, or with alumina. There is one thing in which all foundrymen are interested, and that is, some standard grading of sand. It is now purely a relative matter, nothing absolute about it. If the standard is to be based upon analysis, the ordinary silica, we hold, should run at least 70 per cent, the iron oxide should not be below 6 per cent, and the alumina, or, rather, more strictly speaking, alumina itself should be at least 4 or 5 per cent in addition to what would naturally be confined to the silica. However, the best test which I know for the fineness of sand is simply weighing a certain quantity of your sand, drying it first in the oven at a temperature above the boiling point of water, 212 to 220 degrees Fahrenheit, and putting it through a standard mesh sieve, say 30 meshes to the inch. Of course, if you want 40 meshes to the inch, it can be used. The test is purely relative; but whatever sand you are using you can afford some idea to anybody as to how much of it you can force through a certain sized sieve by shaking it for a definite time. I will say in regard to the activity of iron oxide in a sand, that a molding sand which would come to us without at least 5 per cent of oxide in it would be rejected. The

iron oxide in a sand gives it a red color, of course, but it also gives it a strength and tenacity which nothing else does give it; and if you are using facing on your molds, the one thing to be watched, as far as we know at present, is clay, because clay is nothing but decomposed feldspar. When you have a great deal of clay in your molding sand, which is largely silicon di-oxide, the ash of your facing will fuse up with it and you are going to have a scale on the casting.

Mr. Moore: You state, if I understand you, that you don't consider a sand which contains less than 6 or 7 per cent of iron oxide as proper, at least for your purposes. Do I so understand you?

Mr. Knight: I made that statement. However, we have a great deal of sand that runs nearer 5 per cent, but nothing below 5 per cent will be accepted. Of course, you understand our work is not ordinary work. Possibly you could go as low as 3 per cent for ordinary work; but I can't see how any sand with less than 3 per cent would be accepted.

Mr. Moore: If there were 10 or 15 per cent of iron oxide in the sand, what would be the result?

Mr. Knight: In reply to that, I can only state that I can scarcely see how you could have 15 per cent in your sand, unless you are crushing iron ore for the purpose of putting it into the sand. In that case, it would be possible, if you ground up your ore and put it in the sand. However, your sand would not be increased in strength, because you are simply getting a physical mixture. In molding sand you have iron disseminated through the entire mass in a way you could not possibly do physically, if you were to put it in as a disintegrater.

Mr. Moore: The iron which you find in sand is in what form?

Mr. Knight: In the form of an oxide.

Mr. Moore: And associated with alumina, or with the sharp sand, silica?

Mr. Knight: I suppose you mean whether it is a chemical combination or not, with the alumina or silica? I have never made any analysis in regard to that point. I hardly see how it would be possible for it to be associated with alumina or silica either. It would be in the form of iron oxide. It might be possible to have some such combination as alumina ferride or ferrate.

Mr. Vrooman: I agree with Mr. Knight in what he says as to the necessity for a better grading of sand. At present nobody grades sand alike. A man strikes sand on his farm, possibly in two veins, and he brings it in and says one is No. 1 and the other No. 2. He doesn't know why, nor anybody else. Another man comes along and he says, "I see you are using No. 2 sand." He has struck something that he calls No. 2. It may be finer or coarser than the other man's sand of the same number. The way to grade sand is to put it through meshes. I would say with sand that 90 per cent of it goes through. I would call it by the number of the mesh that you had forced it through after being dried. Then if you bought sand from anybody and found it to be too coarse or too fine by that standard, you could so designate it; you could tell the man it was too coarse or too fine, and he would know how to furnish it to you.

Mr. Sadler: I would like to ask a question. I never had an analysis made of sand but there is an appearance, an indication right where the metal strikes the mold of a white substance that resembles lime. I should like to know what this is. I haven't had any possible guarantee it was lime, but our sand came from a locality where there are large quantities of limestone, and I reasoned that the limestone, or rather a small portion of it, was taken up with the sand. I would like to ask what that white powder is that appears and sticks to the surface of the casting, which if you break it has a resemblance to lime?

S. S. Knight: I don't understand the question the member asks. I have never seen that occurrence in any foundry practice. If he will send me a sample of that sub-

stance, I will tell him what it is if I can.

H. S. Vrooman: I think that is lime, showing the depth to which the red heat has penetrated the sand, and possibly there may be some vegetable matter in it; no doubt, but it is an ash closely resembling lime.

Mr. Sorge: Mr. Knight said he never in any case found a sufficient amount of lime in any sand to do any harm. Will he let me know what percentage he did find in it, and whether he didn't occasionally find carbonate as well as sulphate?

Mr. Knight: In reply to that, any carbonate in molding sand would be in such slight quantity it would not have a tendency to fuse the sand. I couldn't say as to the percentage. I would have to look back over the books. I am sure it was below 1 per cent.

Mr. Sorge: I know there is sand in our direction which contains between 4 per cent and 5 per cent of carbonate. In the locality of Joliet, I know the effect of the lime is very distinct and disastrous there.

Mr. Knight: I can see that if lime comes up to 5 per cent it would be disastrous in coming in contact with hot iron. It is beyond our experience to find any sand of that character.

Mr. Sorge: Joliet sand is what I referred to.

S. S. Knight: I am glad to know such is the case, if there is such a sand; because it was entirely beyond my knowledge that such sand existed.

Charles A. Bauer: I should think if any molding sand contains 5 per cent carbonate, it ought to be ruled out and called by some other name. It has been baptized improperly.

Mr. Sorge: It was ruled out. It was called molding sand for a great many years.

Mr. Vrooman: When I was working at the trade, it was very often the custom—where we had a flat surface—to shake some lime on the face of the mold, which seemed to keep the sand from cutting, and also hold the facing better. There is a simple test that can be made by any body to see if lime is present and will not do any harm—take some muriatic acid and drop it on your sand; if it boils up there is lime in it.

Mr. Sorge: That won't show the sulphate.

Mr. Sadlier: In relation to putting lime on the mold, the trouble comes in at that point where being subjected to heat the change is going on from stone to lime. I have used lime and used lots of it in connection with the reduction of metals. Perhaps on the mold it is all right, creates a moisture and holds the sand together; and oftimes prevents washing. I don't know of anything really much better than a little lime dust used the same as it would be in facing.

A vote of thanks was extended to D. H. Truesdale for his paper.

A resolution of thanks to the Cincinnati committee for favors extended during the convention was passed unanimously.

In the afternoon the delegates, under the guidance of Col. R. C. McKinney, proceeded to Hamilton, where a lunch was served at the offices of the Niles Tool Works, after which an inspection of the works was made.

NOVEMBER MEETING.

At the November meeting the following paper was read by the Secretary:

"PLASTER CASTS AND OTHER METHODS OF MOLDING SHELL FORMS."

By JOHN C. KNOEPPEL.

The art of constructing plaster casts for the purpose of taking off patterns in metal belongs more to the patternmaker than to the foundryman. The molder is not expected to learn this branch of the trade, as it is not universally practiced and probably not understood by many engaged in foundry work, being more in the line of pattern work.

I will proceed at once, to give you a full description of the method, process and manner of molding and casting the same and will try to be as plain as possible so that it will be clearly understood. This form and method of patternmaking is very simple and inexpensive, yet very precise and accurate, especially so on irregular work as patterns that require backing out, such as for deep-figured, carved and ornamental designs. To properly back out a pattern so as to make it the required thickness and at the same time produce an even pattern, requires great care and tedious labor. We all know that to

make patterns for shell forms of any size or shape requires much time and in many cases untrue or uneven patterns are the result, when built of lumber, causing considerable trouble to the foundryman in using the same in sand on account of their being warped and out of shape.

In making patterns in plaster we first have the outer form made of wood in a block shape. Sometimes this outer part is made of plaster by the aid of suitable sweeps and having such ornamentations and figures thereon as are called for by the designer.

When the pattern is completed, have a true board made with battens on and tongued on the end to keep it from warping. Fasten the block to it with screws from the under side, varnish the same and allow it to dry. Then have a flask made for the purpose with an extra nowel part, properly fitted with pins and eyes alike and to suit pattern board. We are now ready for the plaster cast.

Put the pattern board on a bed of sand, fitting the extra nowel to it and clamp the same. Before pouring in the plaster, oil well the pattern and board, olive oil being preferable. Now mix the plaster of paris with water sufficient to give it the consistency of thin mortar, so that it will find its own way to all parts of the pattern, and of sufficient quantity to fill the nowel, allowing it a short time to settle, then strike off and put on a bottom board and secure with screws. Mixing a little parting sand with the plaster hardens it, and it will dry quicker, and have less blow holes and bubbles. After a lapse of fifteen or twenty minutes, roll over the plaster cast and unscrew the pattern from the board, taking off the board, the pattern proper still remaining in the plaster. Rap carefully and draw it out of the plaster. You now have an impression the reverse of your pattern. While the plaster is drying take the block pattern and put it back to its original position, being careful to clean it well before using it for molding from it. At this point you have a concave and convex form of pattern. The plaster cast should be allowed to dry for at least fifteen hours, but could be dried in less time with moderate heat.

We are now ready for filling up the thickness in the plaster cast. Have a true board made with strips of the required thickness fastened to it at each end. This board should be about the size of a kneading board, such as is used in our homes. Mix up a composition of whiting and melted beeswax to the consistency of stiff dough and with a rolling pin roll out suitable sheets, cutting them into different sizes to suit the work, laying and pressing them carefully in and against the surface part of the cast, using suitable tools, the hand and fingers coming into play frequently. Secure the filling with tacks.

This filling or thickness composition should be put only where the pattern line shows, all of it should be well varnished, and when sufficiently dry proceed to mold.

Take the bottom board and pattern, place the nowel for the purpose upon it, being careful that there is no shift, and fit into the pins on board tight, ram this up with sand in the usual way, treating the mold as you would in every case, clamping the same as in the case of patternmaking or molding. Roll over on bed and unscrew the pattern from board, taking it off, draw out the pattern proper and finish in the usual way, then proceed to the cope part. Take the plaster cast and place the cope on it, using the same precautions as with the pattern. Provide suitable gates for pouring and ram this part up with sand also. Roll over, being very careful not to disturb the mold in drawing the cast off the cope. Finish as usual.

We now have both nowel and cope part. Close these two parts together, marking the gating points with flour; take off the cope again, cut the gates, reclose flask and clamp up.

When you are ready for the metal, before closing for the last time, be sure that the parting line meets. A little flour will help to fill up if a little slack, thus producing an economical as well as a very true and reliable mold. Sometimes a right and a left form are necessary; such as for heads, birds, animals and statuary to produce a full form. In that case both sides are made in the manner described above.

While at work some years ago in one of the western foundries, a large number of their patterns were broken and patched so much that they made heavy as well as unsightly castings. The original could not be had, and of course could not be duplicated. I then suggested plaster casts and the work was given me. Using the regular patterns to work from, the first casting was reduced

about ten pounds over the old one. The result being satisfactory, I was given more to make up, due allowance being made for shrinkage.

A large variety of subjects can be made of plaster, and when once acquainted with this branch, many lines can be pursued for plumber's work, tees, elbows, branch-pipes, hoppers, etc. These casts can be preserved for future use, or a number of master patterns may be taken off and stored.

Another good way to take off block patterns is by stripping. While it is not as accurate and precise as the plaster cast, yet it will answer in many cases. The plan is similar to that mentioned but instead of plaster, we work the block directly with sand. The block is made and secured to a true board, as in the case of plaster casts. A cope is fitted to it, and rammed very hard with common sand and rolled over. The board is taken off and the pattern drawn out. Suitable wooden strips are cut to conform to the work and of the required thickness. Now have sufficient paper on hand, cutting the same into suitable strips and lay it on the surface of the mold and nail the paper to the sand until the required thickness is obtained. Then commence laying on the wooden strips, these being cut large or small as required. After all is filled up even with the joint, fill in with fine sand. This might be done while laying in the wooden strips to keep them from falling out of place, being careful not to disturb any part of the mold. Then place the nowel upon the cope and ram up in the usual manner, roll over carefully and take off cope—the cope is what we term a false coping and is shaken out. After cleaning off the pattern prepare the cope in the usual way. Put it on the pattern board with a block fastened thereon, clamping and setting the gate pins and ramming up with sand. This needs to be treated differently from the first case, not ramming too hard, and in the regular way, as in the course of molding. Roll over, take off the board and draw out the pattern. Now finish both parts, nowel and cope. When completed close cope on the nowel, put a little flour on the joint with a bag, lift off and see if joints touch and meet and join securely; see if you have even thickness; then close again and the mold is ready for pouring.

Almost any form of work can be made in this manner, of a smooth character, such as kettles, pipes, drum-tanks, bath tubs, etc.

Still another simple way is to make a core the desired shape with a sweep, drying it and then with the thickness strips lay on the core and ram up.

A few years ago I made a steam receiver with reducing end and flanges, thirty inches in diameter, ten feet long, reducing end being about twenty inches, weighing about 5,000 pounds.

The party wanted only one casting and it would not pay to go to the expense of making a pattern. I proceeded as follows: Sweeps were made to conform to the shape at each end and at the center. A skeleton frame was also made and was laid on core plates made in halves and dried, with proper core irons, having suitable holes drilled and threaded to handle them in lifting. I placed one-half on mold board, placing the flanges at each end, and having the thickness strips ready to lay on the core and rammed up in the usual way with sand; rolled over and made joint. Put on the other half core, and stripped it as in the nowel, being careful that they correspond with each other. Put on the cope and set the gate pins and rammed up. After lifting off we took out the cores and returned them to oven for redrying, finished the mold, setting chaplets and resetting cores, said cores providing their own prints. This was cast in green sand and turned out very good.

DISCUSSION.

In the discussion which followed, Mr. Baire said: We have done some of this work, and in our experience have had good success.

Mr. Sercomb observed that nothing was said in the paper about the effects of expansion or contraction.

Mr. Baire thought that there would be a shrinkage, if anything. If a board was nailed on before pouring, the plaster would shrink away from the frame.

Mr. Ott: I have never had any experience in making ornamental patterns, but I have made a great many casts of plaster of paris. The only time that I ever found plaster of paris expanded was when we put the wood into sand. I would suggest the use of

emery dust instead of sand. It causes the plaster cast to harden so that you can hardly cut it with a chisel or knife. I always use emery dust if I can get it. I have made light plaster of paris patterns, but I have never paid much attention to the expansion or contraction.

Mr. Smith: I have seen this work done about eighteen years ago. We made a kind of mantel work and in making the mantel shelves at that time we called this reversing. I did not understand it as pattern making but as molding. We made it directly in green sand. We took a copy from the pattern made from layers of a composition of clay. I should like to know which would be the more expensive: to make the mold directly in green sand or from plaster casts.

Mr. Louis Knapp: Instead of being confined to the iron foundry, I think if we should talk this over with people interested in bronze and light metal work, they would give us some information. They do a great deal of this plaster work. It is very fine for core-boxes.

Mr. Ferguson: Although I am not very familiar with reversing or making of patterns, as described, the principle of the thing is applied, I believe, in all foundries—in all classes of molding, green, dry sand and loam—in getting the one side of the pattern. Suppose you are making a stove-door. You make a plaster cast of the door and make the bottom part of the mold and get the top from it. The same thing is applied in making a kettle, exactly. Sweep up the outside and inside the full size and then take off the thickness. It is the same principle. So it is true in making pipe of all kinds. I think you will find it in regular practice everywhere.

Mr. Thompson: I can see where the putting on of this strip can be of considerable advantage in ornamental work or in the making of core-boxes. But in making a pipe or receiver it seems to me that the ordinary way of sweeping up from a spindle with bearings at each end would be a cheaper way of making the casting. This material is expensive. The same in making kettles and anything that can be swept up. I do not see that there is any advantage gained by using any material for putting on the thickness, where the outside diameter is swept up first and the cope rammed on that and then the thickness put on the sweep and the sweep put on the mold after the cope has been taken out, and the thickness swept up. This way, it seems to me to be plainer and cheaper, and I think we can apply it to everything but ornamental work.

Mr. Baire: The gentleman is right there. As I understand it, this method is used principally on ornamental work. In pipe or kettle work you can sweep readily in green sand and it is much easier than plaster of paris by having a double sweep.

Philadelphia Foundrymen's Association.

At the sixth annual meeting held at the Manufacturers' Club, Philadelphia, the following officers were elected:

President—P. D. Wanner.

Vice-President—Antonio Y. Pessano.

Treasurer—Josiah Thompson.

Secretary—Howard Evans.

Executive Committee — Walter Wood, chairman, Thos. Glover, E. E. Brown, Stanley G. Flagg, Jr., Wm. F. Sauter.

The expressions made as to the state of the foundry trade did not reflect any apparent improvement in either the volume of business offered or the prices obtained.

Mr. Moore, of Elizabethport, N. J., said that a recent trip abroad had convinced him that he could have taken orders in England for castings at satisfactory prices to himself and at less than the prevailing price in that country, where ordinary castings cost from two and one-half to three cents per pound.

Malcolm McDowell, of Chicago, read a paper on "The Practical Value of the Various Metalloids in Cast Iron," which represented further investigations made by the author, since presenting his last paper before the Western Foundrymen's Association.

When some peripatetic individual comes around offering to sell you gold dollars for twenty-five cents, you look to see what you are getting for your money. Men are not given to selling gold dollars on that basis. This holds just as good in machinery as in dollars. Always see that you get what you are paying for, and never think you are getting a thing cheap because you are getting it for little money.—Machinery.

CAST IRON NOTES.

Devoted to inquiries from Practical Foundrymen on the subject of Melting and using Cast Iron. Address all Inquiries to W. J. KEEP, care of The Foundry.

LETTERS LOST.

Owing to an accident all mail received by me during the first week in November was destroyed. There were at least three letters containing questions. Being out of town I didn't read these. Will the writers be so kind as to repeat the questions.

W. J. KEEP.

A SHOP TEST FOR HARDNESS.

MR. CHAS. A. BAUER'S TEST.

There have been various attempts at devising a test for hardness. Professor Thomas Turner's apparatus measures the load placed on a diamond necessary to cause it to cut a polished surface. It takes considerable practice to be able to tell when the diamond begins to cut, and different observers are not likely to see alike. For chilled surfaces, or for hardened steel, this is probably the best test yet devised. However, the skill required prevents its being used as a shop test. Gray iron, or iron that can be cut, is more generally used than the irons which cannot be cut, in fact a machinist will judge of hardness by the ease with which a file or tool will take hold. The other day I saw, at the Detroit Emery Wheel Works, a test for the cutting quality of an emery wheel. A rest was provided which moved without friction and which was pulled towards the wheel by a cord passing over a pulley, to which was hung a certain weight. A bar of steel of a given size was fastened to the rest. The emery wheel was run at the most desirable speed and the length of bar cut away in one minute denoted the cutting quality of the wheel. If a test bar is held against such a wheel the length that is cut away in one minute is a test of hardness.

For a test to be of any value all conditions must at all times remain the same.

For it to be a shop test the result must be purely mechanical and not depend upon the judgment of any one.

Mr. Bauer, who is the general manager of the great harvester works of the Warder, Bushnell & Glessner Company, of Springfield, Ohio, has spent much time in determining the most economical speed at which drills of different sizes should be run, and the best angles for the cutting edges. If the temper and quality of the steel in the drill is always the same, and a definite size of drill is used, and a definite pressure is put upon it, Mr. Bauer thought that the number of revolutions of the drill, required to penetrate a casting to a given distance, would be a good shop test for hardness, and probably the best test that could be devised.

When I first saw a description of Mr. Bauer's device in the American Machinist, April 1, I proposed that I should make a machine for general use and this being agreeable to him, I set about it. The machine will soon be completed. It will consist of a horizontal drilling device, with a guide to insure the drill entering the test bar exactly midway between its sides. This horizontal position will insure the free exit of chips. The drill will be driven by a clutch pulley attached to its spindle. Working in a small pinion on the spindle is a cut gear making one revolution for every ten of the spindle. The axis of this slow gear is a long screw, 20 threads to the inch. Sliding on suitable guides, and moved by this screw, is a table holding a record paper. At right angles across this table a pencil is moved three times as far as the drill enters the test bar.

To drill through a 1-2 inch square test bar at the same rate that Mr. Bauer's machine drilled soft cast iron, would take about 200 revolutions. For 200 revolutions the screw will move the paper lengthways one inch, and the pencil will move at right angles 1½ inches while drilling ½ inch deep. The diagram will thus be the diagonal between the starting and ending point. The shape of the diagram will show the hardness of the skin of the test bar, and increase in softness towards the center. If any spongy spot is found the diagram will show it.

By constructing a series of diagrams on transparent celluloid and numbering them the relative hardness of skin and center can be determined, by laying the transpareney over the record and finding to which standard diagram it more nearly corresponds. Steel hardened so that a drill cannot cut it would give a straight longitudinal line for a diagram. If the drill were allowed to move

forward with nothing in front of it the diagram would be a straight lateral line at right angles to the diagram of a perfectly hard material. Diagrams of all materials must lie at different angles between these extremes, and any variation of any part of the diagram from a straight line will indicate a variation of hardness in different parts of the test bar. As each 1-20th of an inch on the diagram measures ten revolutions of the drill, and the large wheel being graduated to 1-10 of a revolution, the exact point when the lip of the drill enters or leaves the surface can be determined. The action of the machine is wholly automatic. When the drill rests on the test bar with 160 pounds pressure, by touching a lever all parts move together, and when the drill leaves the other side of the test bar the pencil records the instant, and the apparatus stops without an extra fraction of a revolution.

It is thus seen that the operation is wholly mechanical and that any boy can locate the test bar and start the machine. When the diagram is complete the machine stops and when the foreman comes along he can subtract the former reading on the large gear from the present reading and measure the 20th inch length, and he has the revolutions to 1-10 of a revolution. For convenience an ordinary revolution counter will be attached to the long screw to read to 10,000 revolutions.

On the forward end of the spindle will be placed a corundum wheel and a grinding device, by which the drill will always be ground exactly the same at all times. The Morse Twist Drill Co. agree to make drills for this apparatus that will not vary in quality and the grinding wheels will be of uniform composition.

When the apparatus is completed a hole will be put through each of the test bars which were made for the American Society of Mechanical Engineers in 1894. As this hole will be alongside the hole from which drillings were taken for analysis, and as the bars were ½, 1, 1x2, 3 and 4 inches square, and as there were 19 different mixtures of iron, the records will be very valuable. It is expected that before spring a paper describing these tests will be prepared, and that Mr. Bauer will also prepare a paper describing all of his experiments, by which he arrived at the adoption of a drill test for hardness.

Mr. Bauer deserves all the credit for the adoption of this test for hardness. It will be a true shop test and at the same time fitted for the most accurate work.

Determining the Hardness of Cast Iron.

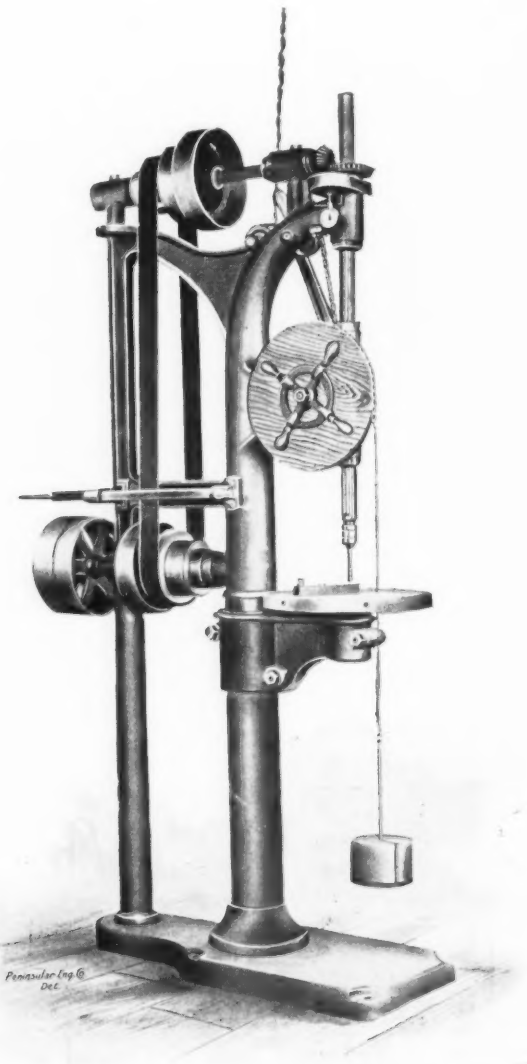
Every foundryman knows that castings differ in hardness, having more than once had his attention called thereto by those detailed to do the machine work on his product. Strange enough the hardness of cast iron has been largely passed upon by individual judgment without resorting to any definite method of proving its correctness.

Charles A. Bauer, general manager of the Warder, Bushnell & Glessner Co., of Springfield, O., does not depend upon individual judgment in this matter, but has perfected an arrangement whereby he is able to form a nearly true opinion of the hardness of the metal he is using, without trusting to the fallibility of man. From each heat a number of test bars are made, and after being submitted to a transverse test to determine their strength one or more of the pieces are taken to the machine herewith illustrated and tested for hardness. We are indebted to Mr. Bauer for the following description of the apparatus and the method of applying same:

The frequent complaints from our machine shops in reference to the hardness of cast iron has made it desirous to add to our daily physical tests some simple, practical method for determining the hardness of cast iron. All known methods were found to be too complicated or impractical for daily use, and we concluded that as a drill revolving at a reasonably uniform rate of revolutions under a constant pressure would drill a given depth with a certain number of revolutions, it would require more or less revolutions if the metal is harder or softer; we have, therefore, adopted the following method, which is giving us all the information that could be desired.

An ordinary drill press is equipped as follows: On the pinion shaft, which raises and lowers the spindle, is attached a disc 12″ in diameter, around the periphery of which is placed a light plumber's chain, on the end of which by means of a wire is suspended a weight which maintains a constant pres

sure on the drill. We have placed a small platform scale on the drill table, then placed the test piece to be drilled on this scale, and found the actual pressure on the drill to be 160 pounds while making a test. A 3-8″ flat drill is placed in the chuck after being carefully ground in the tool room by aid of a fixture to a known thickness, angle of lip, etc.; though this uniformity of grinding is not depended upon solely for the accuracy of the results. The drill spindle has a revolution counter, and by means of magnets and an armature is controlled by the position of the drill in relation to the table. All adjustments are made so that the revolution counter is thrown into gear after the point of the drill is entirely embedded under the surface of the test piece, and out of gear when the spindle has descended from this point exactly 1-2″. When a test is to be made, the test bar is placed on the table and the drill is brought down upon its surface; the feed



MR. BAUER'S APPARATUS FOR DETERMINING THE HARDNESS OF CAST IRON.

lever is then unlatched and everything is as shown; the drill is now rotated about 250 revolutions per minute and the hole drilled. The revolution counter is electrically thrown into gear after the drill point is buried beneath the surface, and out of gear when the 1-2″ from this point has been drilled. The reading of the revolution counter now gives us the exact number of revolutions required to drill the 1-2″, and this we term the degree of hardness. The more revolutions required to drill this 1-2″, the harder is the casting, and a slight degree of hardness is easily detected.

As to the reliability of the test: We have drilled ten holes into the same bar and received results varying from 166 to 170 revolutions, the average being 168.2; the variation, therefore, being less than 1 1-2 per cent. In order to assure ourselves that the condition of the drill had not changed, a test piece previously drilled, and for which 173 degrees of hardness was obtained, was redrilled with exactly the same result. The condition of the drill is obtained each day by drilling a test piece of previously determined hardness, and then comparing the result with the previous one; the increase in revolutions represents any change which may have taken place, and from this a constant is obtained, and the pieces tested that day reduced to the standard. When we obtain a constant of 1.2, the drill is resharpened and its new constant established as above. We make not less than two tests each day, and found it necessary to resharpen the drill but three times during the past year.

Correspondence.

FALSE MELTING RATIOS.

Editor THE FOUNDRY:

In a recent number of your journal I am pleased to note a reference to the making of false statements in regard to melting.

I am not jealous of any man that can produce his metal cheaply and if he has a way of melting 1 to 10 or 12, he is doing very fine, but if he is not he will do the foremen of the country a great favor by telling just what he is doing and not what he thinks he can do. He will also prove himself a public benefactor by giving a clear detail of the size of his heats, class of work and distance to carry iron and what he has to handle his iron with.

It has been my experience, and I think that of my fellow foremen, to have the owners come to me about once a month wanting to know why I cannot do better than I am doing. They will say: We see by different papers that so and so are melting 1 to 10 or 12 and you are only melting 1 to 8½ or 9. I had an experience once with a company I was foreman for, which probably all foremen have had to go through. The superintendent came to me one day and said he wanted to have a serious talk with me about melting. That he knew for a fact of a foundry foreman who was melting 1 to 14 and thought it time we did something to better our melting. I told him I did not believe it, but he had his information from such good authority that he felt sure it must be right and would not listen to anything said against his statement. We had a shop 250 feet long, 110 feet wide, with a cupola in one end of it and had no way of delivering the iron throughout the shop except by handling it from one crane to another. Our work was light and required hot iron and melting at 1 to 8½, the iron was none too hot by the time we could get it to the mold. We were melting pig iron and heavy scrap.

I wanted to do all I could and so we started to do better. We increased the speed of the blower and cut down the usual amount of coke; got dull iron and lost castings. The iron appeared to come hot enough from the cupola, but did not have life enough to stand the handling down the shop. The ladles bunged up and our intended economy resulted in a regular mess and the opinion that I did not understand melting. We weighed every pound of coke and iron and did not measure it by a box, supposed to hold so much. Ours was actual weight. Later I made it my business to find out some further particulars about the shop, which had furnished the record we tried to reach. What was my surprise to find that in charging they called a certain number of pieces of pig iron a ton, and the coke was measured out by a box supposed to hold 400 pounds level full, but a man could easy put on a 100 pounds more if he felt so inclined.

I know iron can be melted 1 to 10 if it can be poured immediately without carrying it too far, but take a jobbing foundry

where different castings are turned out each day, and where there is always going to be some iron left, in pouring heavy pieces, which must be taken back to the cupola and the case is different. Here some of the iron must be hot enough to run stove plate and some has to be chilled down for heavy chunks, and I consider, taking it altogether, that 1 to 9 is good melting. These high reports have done more towards creating dissatisfaction, and in many cases resulted in the discharge of competent foremen, than any other thing in the foundry business. I believe the best thing that can be done to counteract this evil influence is to look up all these high records, and find out the exact circumstances under which they are made. It might pay us to hire some of these makers of abnormal records to teach us how it is done, if they can prove their claims, but we do not want any guessing to count in place of actual figures. We want to know only what a man does and not what he considers possible. When we want examples of cupola practice, we want cupola practice and not cupola theories.

B. F. PRINCE.

Since writing the above I have learned that the record-breaking foreman who advised my superintendent that he melted 1 to 14, has been discharged from two shops within a year. If he actually saved money for his employers, why did they not retain him? False statements in regard to melting only adds to the difficulties the foreman has to contend with.

DRYING MOLDS BY COMPRESSED AIR.

Editor THE FOUNDRY:

In the November FOUNDRY there appears a paper on "The Progress of Compressed Air," by J. F. Lewis, in which appears the following:

In a letter from an expert consulting engineer on foundry practice and equipment, one who is well up in the business and stands high in his profession, but whose modesty would not permit his name to be used, he writes as follows: * * * I consider compressed air heated to the temperature of about 400 degrees and introduced into a closed mold as the very best and most efficient method of drying these molds preparatory to casting, and I believe the future will see great developments in this line. A mold which ordinarily takes from 8 to 10 hours to dry in a core oven with very uncertain results can be positively dried in 20 to 25 minutes by the use of hot compressed air under a pressure of from 3 to 5 pounds, and the result is absolutely certain and perfect. Furthermore, by this method, the steam generated in the mold finds its way outward through the sand and vents, and leaves the mold in a much more perfect manner than when dried from the outside in an oven.

I have been experimenting in this line for some time, but find that I am unable to secure even three pounds pressure. Do you think my molding sand is too open? I find that the air leaks out before it reaches much of any pressure; in fact, there seems to be a whole lot of punctures in the mold. Will you please tell me how to plug them up?

I also find that air introduced in the mold under pressure has a tendency to cut up the sand. How should this be remedied?

JAMES DUNN.

Up-to-Date Furnace Practice.

With the more scientific methods of making use of iron and steel there has come the demand from foundries for a more intelligent way of mixing irons, and especially for pig iron of uniform quality. As the smaller foundries cannot go to the expense of equipping and maintaining a laboratory, it is necessary for them to depend largely upon parties from whom they buy to give them iron of uniform quality.

Foundrymen have been much interested in the Buffalo Furnace, at Buffalo, N. Y., where is made one of the most uniform, if not the most uniform foundry iron anywhere in the United States to-day. When this furnace was built in 1892, its owners recognizing this demand from the foundries, and having determined to produce foundry iron as a specialty, started in with this idea, viz., to make the best foundry iron that could be produced from lake ores, and one that was absolutely uniform and could be depended upon in every instance. To secure these results the iron is made from all Lake Superior ores, this is guaranteed, and the same kinds of ores are being used to-day that were used five years ago. These ores are all analyzed at the mines, again at the lake port when they are loaded into vessels, and again at the furnace as they are unloaded.

so that this almost precludes the possibility of there being any great variation in the quality and characteristics of the ore. To further secure uniform iron the furnace analyzes every cast of iron made. To get a fair average analysis of each cast they take a small ladle of molten metal at the beginning, again at the middle, and again at the end of each cast; this iron is poured into small molds, and an equal amount of borings from each mold is taken, mixed together, and an analysis for silicon and sulphur made at once. This analysis is given at once to the grader, who, having the analysis of the iron before it is taken from the cast-house, designates to which part of the yard the iron is to be taken, and as soon as the iron is sufficiently cool to handle it is carried out on flat-cars to a high trestle from which it is broken, and graded by physical fracture. When graded, each pile of iron is marked with its cast number and also in such a way that the manager, by reference to the furnace records, can tell at any time just what the analysis of each pile is. A record is kept of the analysis and grade of each car shipped each customer so that the furnace is in position at all times to exactly duplicate orders and give the customer iron which is exactly the same as was shipped him before.

In addition to the sulphur and silicon analysis made in each cast, a complete analysis of the iron is made every day or so. This is done with special reference to keeping a close watch on the carbon, as these people feel that the graphite carbon in foundry pig iron plays almost as important a part as the silicon, and it is their aim to keep the graphite carbon in the Buffalo iron as high as possible.

The furnace is equipped with every modern convenience for handling material economically and for securing uniform results; one of which that is especially interesting is the pyrometer, which automatically registers the heat of the stoves during the entire twenty-four hours, thereby enabling the manager to know exactly what was the heat of the blast at any hour. With this pyrometer it is possible to keep an approximately even temperature and so reduce to the minimum any variation of silicon and carbon which occurred in each cast of iron under the old method of recording the temperature of the blast.

Following these methods it, of course, necessitates carrying a large stock of iron at all times for the reason that while they only make the usual grades of iron, but grading by analysis as well, each one of these grades are subdivided, which makes the furnace carry from 30 to 50 different grades of iron all the time, and naturally the demand at one time will be greater for a particular grade of iron than for another.

The users of the Buffalo iron gladly testify to its exceptional characteristics, particularly its uniformity, and its great scrap carrying capacity. The result is that this iron has become the recognized standard foundry iron wherever used, from Buffalo to New England.

Obituary.

Levi F. Mercer, an old foundryman, died at Laurelton, Pa., recently.

John Magee, founder of the Magee Furnace Co., died at Beverly, Mass., Nov. 5.

Thomas Gavin, of the Plymouth Foundry Co., Plymouth, Mass., expired in Watertown, Mass., Oct. 18.

Alonzo Josselyn, for many years a prominent foundryman of Boston, Mass., died in that city Oct. 29, aged 79 years.

John W. Perkins, senior member of the Perkins Foundry Company of Amsterdam, N. Y., expired in that city recently.

Prestwood J. Benbow, manager and president of the Otis Steel Co., Cleveland, O., died Nov. 5 from injuries received two days previous, in being struck by a Lake Shore train. Mr. Benbow was a native of Birmingham, England, where he was born in 1840. As a young man he made an extended visit to the United States, returning to England in 1862, when he associated himself with Lockhart, Tozer & Co., and became manager of the Manchester branch of that company. He came to the Otis Steel Co. in 1892 and a year later was appointed as general manager of their American interests.

$ $ Count Here.

I get more benefit from the $ I spend for The Foundry than from money expended in any other way. M. F. RICHARDSON.

Bellevue, O.

Welded Rail Joints.

In the October issue of THE FOUNDRY there appears a paper on "Welding Rail Joints with Cast Iron," which was read by Mr. Newkirk before the Philadelphia Foundrymen's Association. Through the courtesy of the Engineering News we are enabled to present our readers with illustrations of the method and its application, and we are also indebted to the same journal for the following description:

The rails where the joint is to be made,

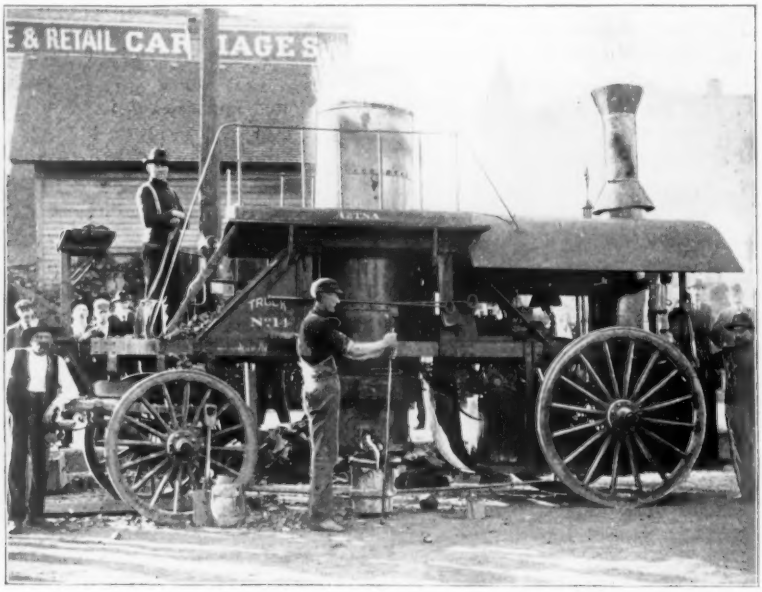


FIG. 1—PORTABLE CUPOLA FOR WELDING TRACK JOINTS.

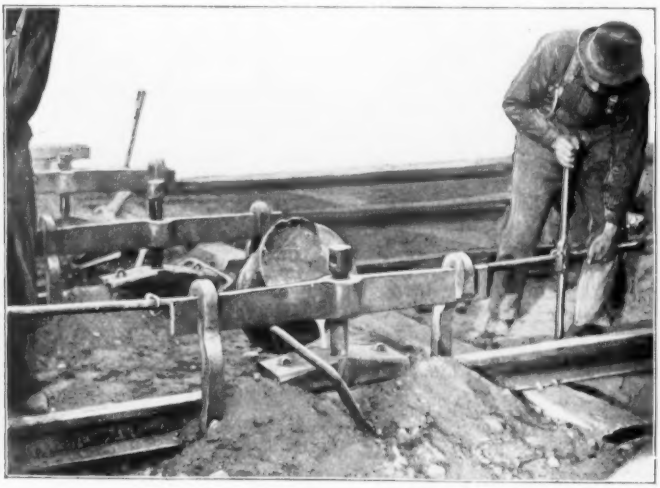


FIG. 2—POURING THE JOINT.

are first thoroughly cleaned with files and emery paper. Cast-iron molds are then placed around the joint, held in place with clamp screws both horizontally and verti-

cally. It was found necessary to have a very heavy vertical screw to prevent the joint from heaving on account of expansion due to the heat developed. After the molds were placed, the molten metal was poured

FIG. 3—VIEW OF THE MOLD OPENED AFTER CASTING.

and the joint thus completed. After cooling the molds were removed and any rough edges left were trimmed off. The joint is made so that a flange way is formed in the cast. The company owns two of the so-called cast-welding machines made by the Falk Manufacturing Company, Wisconsin, and one of them is shown in Fig. 1.

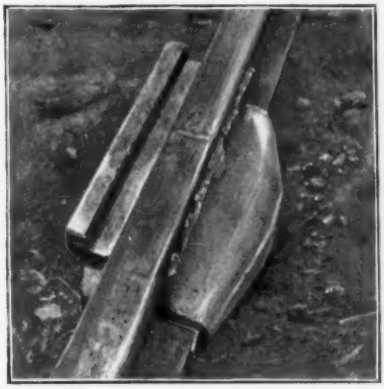


FIG. 4—VIEW OF COMPLETED JOINT.

The cost of the machine is about $2,500, and the capacity 8,500 lbs. per cast. The joint for the 80-lb. rail requires about 138½ lbs. of metal, and the cost per joint is about $2. This includes the cost of fixing the rails to receive the joint. A 45-lb. rail requires 102 lbs. for a joint, and a 54-lb. rail requires 115 lbs. for a joint. A mixture of half pig and half scrap castings gives the best results.

The system here illustrated is used by the Street Railway Companies of St. Paul and Minneapolis.

Among the Foundries.

James A. Allen is erecting a new foundry at Adams, Mass.

George N. Frazer will erect a new foundry at Eugene, Ore.

The Semi-Steel Casting Co.'s foundry at Montpelier, Ind., burned Oct. 16.

The Reading (Pa.) Car Wheel Works has begun operations in its new plant.

The foundry at Bushnell, Ill., operated by the Neff Mfg. Co., was burned Oct. 9.

William Marrin will locate a brass foundry at 5 Division street, Utica, N. Y.

C. M. A. Sorensen has purchased the Mehoopany (Pa.) Foundry & Machine Works.

The Enterprise Foundry Co., of Belleville, Ill., has increased the capacity of its plant.

Rowe & Moore have leased the foundry at Broadhead, Wis., formerly operated by J. W. Dies.

Capt. Charles A. Colcord has purchased the W. O. & C. Barney foundry at Seasport, Me.

The foundry of the American Iron Bed Co., at Atlanta, Ga., was destroyed by fire Oct. 14.

Elliott & Hutzman's foundry at Williamsport, Pa., was visited by a small fire recently.

W. F. Runnels has purchased the foundry at Bradford, Mass., formerly operated by H. B. Hoyden.

The Fuller & Johnson Foundry Co., of Madison, Wis., have secured a large order from Sweden.

The Bennett-Nance Stove Co., of Quincy, Ill., had their plant almost totally destroyed by fire Oct. 27.

A pattern house, belonging to the Clark Foundry & Machine Co., of Knoxville, Tenn., was burned Oct. 16.

The old foundry of Hoyt & Wynkoop, at Troy, N. Y., has been reopened by James Hislop as a malleable iron works.

W. C. Ephart has leased the foundry and machine shops of Bigger Bros. at Dushore, Pa., and will take possession Jan. 1.

The Shields Foundry Co., capitalized at $6,000 has been incorporated at Mansfield, Mass., for the manufacture of stoves.

The Lake Shore foundry of Cleveland, O., is reported as considering the establishing of a plant for making basic steel castings.

The Crowe Foundry & Machine Co. has been incorporated at Middleborough, Ky., to engage in the general foundry business.

Fred Krause will have charge of the foundry department of the Casey & Hedges Mfg. Co., at Chattanooga, Tenn., after Nov. 1.

The Western Malleable & Grey Iron Mfg. Co., of Port Washington, Wis., are erecting new shops at Milwaukee, and will remove to that city.

Heintz Bros., of the Pacific Iron Works, Portland, Ore., have purchased a new site, where they will erect a modern foundry and machine shop.

The Plattsburg Foundry & Machine Co. has been incorporated at Plattsburg, N. Y., with a capital of $6,000 and the following directors: Sidney S. Whittlesey, John Boss and John M. Wever, of Plattsburg.

The Columbia Foundry & Machine Co., St. Joseph, Mo., will build a large and well equipped foundry during the winter, as their old plant is not large enough to handle their business, which has grown very rapidly.

The A. Y. McDonald & Morrison Mfg. Co., Dubuque, Ia., expect to move into their new foundry buildings within the next sixty days, and will then be able to boast of one of the finest plants of the kind in the west.

Headford Bros. & Hitchens Foundry Co., Dubuque, Ia., will enlarge their plant to double its present capacity in January, as they are at present unable to take all the business offered, owing to the lack of floor space.

The foundry of J. & E. Stevens Co., at Cromwell, Ct., was burned Oct. 13. They have decided to rebuild with new buildings constructed as near fire-proof as possible. The framework of the buildings will be steel and the coverings will be corrugated iron. The Berlin Iron Bridge Co., of East Berlin, Ct., have the contract for furnishing and erecting these buildings in accordance with their designs.

Patents.

The following is a list of recently granted patents, pertaining to furnace and foundry practice:

Date.	Name.	No.
Aug. 31—	Blast furnace, F. H. Foote	587522
	Smelting and refining furnace, M. L. Trapp	587622
Aug. 10—	Melting furnace, H. W. Falk	587718
	Metal-mold, Griffith & Slatterly	587728
Aug. 31—	Smelting Furnace, B. Hall	589210
Sept. 7—	Annealing plant, F. J. Freeman	589597
	Metalurgical furnace, S. T. & C. H. Wellman	589769
Sept. 14—	Casting machine, J Hall	590148
Sept. 21—	Iron, Treating phosphonic, A. J. Roussi	590239
Oct. 26—	Flux for welding metals, P. Quinn	592642
	App. for Cleaning cast metal surfaces, D. C. Green	592739
Oct. 5—	Obtaining cast Titanium, H. Morssan	591355
Oct. 21—	Automatic Blast Generator, A. M. Sidwell, Jr.	591699
	Molding apparatus, L. Fingal	591463
Oct. 19—	Smelting furnace, F. N. Bergan	591945
Nov. 9—	Blast furnace and means for charging same, T. Lewis	593358

A printed copy of the specifications and drawings of any of the above patents will be furnished by Fisk & Thomas, Hodges Building, Detroit, Mich., for 25 cents. In ordering, give date, name and number.

A Parisian doctor claims that a solution of one part of picric acid to seventy-five parts of water will surely and speedily cure the most terrible burns and scalds, and recommends that a supply of the solution be kept in foundries, etc., for the use of workmen. The pain is said to be instantly removed, sores and blisters prevented and a cure completed in four or five days.

Cleanliness in the Foundry.

By V. WOLFE

I have often wondered why molders could not, as a rule, and not as an exception, be as tidy in their personal appearance while at work, and in the manner in which they kept the space allotted to them as the machinist, woodworker, or even the pattern-maker. If a visitor were to go into any of the large factories in the United States or Canada knowing nothing of the class of work being done, but simply as an observer, he would be impressed with the general disorderly appearance of the molding shop as compared with other departments.

I know how difficult it is for a molder in a jobbing shop to keep his floor clean and in order. He seldom has the same job two days in succession and from the varied nature of his work cannot well keep his flasks and other appliances in good shape. But he can at least keep his gaggers, clamps and wedges in boxes or piled up in a place selected for them and used for no other purpose. He can, at least, order the flasks that he does not intend using that day taken out of his way, and he can impress upon the mind of the foreman that it is necessary to have them taken away soon. He might even go so far as to admonish the laborer who takes the flasks out that it would be a good idea to pile them up in decent shape on timbers provided for the purpose, so that the next time they were needed they would not be frozen to the ground, or covered with mud or half rotten from contact with the earth.

While a jobbing molder may be excused for not keeping a very orderly house, stove plate and agricultural molders should be imbued into the idea that cleanliness is next to godliness. They have jobs that run for weeks or months without change and there is no excuse for using the shelves that are provided for holding cores, patterns and tool boxes as a receptacle for clamps, gates, scrap, old shoes, castings that they think they can save by plugging, or filing, or worse than all their coat and vest. Drive a nail in the wall for the last named articles.

I have been in foundries where a lady could walk down the gangway and up the aisles between the floors without soiling the hem of her dress. I have been in others where she would be compelled to raise her skirts to an indecent hight for fear of having her garments come in contact with the hundred and one obstructions that were piled up in confusion everywhere. It is just a matter of pride and taste on the part of the foreman and men which kind of a house they want to keep, and each individual molder can do his part toward making the choice.

It is perhaps, to a large extent, the fault of the foreman that molders are habitually careless with regard to the appearance of their floors, but it is a hard matter for one man to control the habits of fifty. He may lay down ever so many rules and the chances are he will have to threaten discharge before he is obeyed in every case, and the gentlemanly foreman of the present day dislikes to make use of his power to that extent. It is better to reason the thing out. I remarked to a particularly careless man not long ago that I believed if he was to go home at night and find the kitchen in as deplorable a condition as his floor was at that time he would be tempted to excuse himself from eating any supper, but would instead go over to the White Swan Inn and fill his hide with family disturbance.

No doubt there are some shops where the proprietors are too niggardly in providing help for the foundry to admit of cleanliness and order, but such shops are few. If every foreman were to insist that the molder should brush off the top of his flasks, that he should keep strictly to the line of his own floor, that the space between his floor and his mate's should be kept free from scrap and rubbish, that all flasks, clamps, patterns, etc., which he was not using should be taken away, and were he to insist that a place be provided to store all articles not in immediate use, were he to see that the gangways were swept at least once a day and all shelves and benches brushed off at the end of the day's work, then it could not be charged as it is now that in most all factories the foundry is the most slovenly department in the whole concern.

If there is a hot place awaiting anyone, it ought to be reserved for the individual, who claims to melt 16 to 1. There has never been any conclusive proof offered that this has been done.

Plumbago Club.

Yes, the Plumbago Club held another session in Cincinnati during the meeting there recently of the Western Foundrymen's Association.

This information is not intended for any of the gentlemen who were present, because they will never, never forget it, but it is rather designed for those unfortunates who could not be in the Queen City at that time or who did not receive an invitation, and who, of course, depend upon THE FOUNDRY for all the information they receive from outside sources.

There were many rumors afloat during the earlier days of the meeting concerning a number of special features that would be introduced at the next session of the club, but only those on the inside knew that a ritual had been prepared and that the initiation ceremony contained some unique features, especially designed to test the nerve and prove the endurance of those who desired to become members of the most famous social organization on earth next to the "Lime Kiln Club."

Immediately after the close of the banquet on Tuesday, October 19th, the club was called to order, and after the transaction of routine business, the ceremony of initiation was proceeded with, and those whose curiosity overcame their judgment were given an opportunity to inhale the smoke and steam raised in the club room by the pouring off of a large number of ladles and the burning of the gas in a great many very strong cores.

Many a good molder has been prostrated by the severity of his work and has shown it by his personal appearance, but nothing we have ever seen could compare with the careworn expression and evidence of fatigue shown by some of the gentlemen who felt their way through the dark to the throne of the club's great Plum-Plum-Ji, and had there imparted to them the knowledge that must be secured by any applicant for membership in this famous institution before he can pride himself upon full membership.

The officers of the club as at present constituted are as follows:

Plum-Plum-Ji .....J. D. Smith
Rajah .....B. T. Bacon
Nizam .....John A. Penton
Colombo .....H. F. Frohman
Swami .....J. A. Green
First Huzoor.....T. L. Griffith
Second Huzoor.....S. T. Johnston
First Punkah Bearer.....J. K. Pollock
Second Punkah Bearer.....John Hill

While many reports have been circulated at different times as to who were or who were not members of this much talked of society, and while many individuals have presumed for one reason or another to claim membership, THE FOUNDRY is in a position to publish for the first time an accurate list of those who have survived the ordeal of initiation, have carried the requisite number of ladles and poured off their allotment of heavy castings.

Every member of the club is supposed to be branded with a certain number. This being done to facilitate identification under certain circumstances.

The names of the members and their numbers are as follows:

No. 1—J. D. Smith, Cincinnati, O.
No. 2—H. F. Frohman, Chicago, Ill.
No. 3—J. A. Green, Cincinnati, O.
No. 4—S. T. Johnston, Chicago, Ill.
No. 5—T. L. Griffith, Cincinnati, O.
No. 6—J. K. Pollock, Cincinnati, O.
No. 7—H. S. Vrooman, Chicago, Ill.
No. 8—W. N. Moore, Joliet, Ill.
No. 9—C. A. Sercomb, Milwaukee, Wis.
No. 10—John Hill, Cincinnati, O.
No. 11—A. Sorge, Jr., Chicago, Ill.
No. 12—Geo. W. Cope, Chicago, Ill.
No. 13—John A. Penton, Detroit, Mich.
No. 14—J. S. McCormick, Pittsburg, Pa.
No. 15—C. A. Bauer, Springfield, O.
No. 16—A. C. Hawes, Chicago, Ill.
No. 17—L. Haney, Cincinnati, O.
No. 18—H. J. Gosiger, Cincinnati, O.
No. 19—G. McG. Morris, Cincinnati, O.
No. 20—John B. Morris, Cincinnati, O.
No. 21—B. T. Bacon, Chicago, Ill.
No. 22—Geo. M. Sargent, Chicago, Ill.
No. 23—John Sadlier, Springfield, O.
No. 24—H. M. Reynolds, Dayton, O.
No. 25—C. S. Bell, Hillsboro, O.
No. 26—J. H. Shaffer, Pittsburg, Pa.
No. 27—C. F. McGilvery, Springfield, O.
No. 28—H. G. Byram, Indianapolis, Ind.
No. 29—F. V. Knauss, Portsmouth, O.

No. 30—E. K. Rundle, Milwaukee, Wis.
No. 31—M. D. Cheeseman, Quincy, Ill.
No. 32—F. S. Cadwell, Cincinnati, O.
No. 33—J. W. Gardner, Quincy, Ill.
No. 34—J. C. Brainard, Cleveland, O.

The next session of the Plumbago Club will be held in Cincinnati, O., during the convention of the American Foundrymen's Association, which will meet in that city during the month of May, 1898.

From indications and the information at hand, it would seem to be the ambition of every man interested in any way in the foundry business in America to become a member of the club, and the officers are going to see that the sand is all cut up properly, tempered, patterns and flasks ready for the heaviest heat ever poured off in America.

Every precaution will be taken to see that the cupola is properly charged and that the blast is turned on early, and from the moment the iron commences to run until the bottom is dropped the fun will be fast and furious, and nervous people who are apt to grow hysterical, or dyspeptics whose digestion is likely to be affected by too much laughter, are warned not to attend.

If the amount of work on hand exceeds the capacity of the cupola, an extra heat will be provided for.

It is needless to say that suitable refreshments will be served to those who may be prostrated by the strain put upon them, and that it will not be absolutely needful for those who desire to become members to make their wills or put their earthly affairs in order before surrendering themselves into the hands of the Punkah Bearers preparatory to the initiatory rites.

American Foundrymen's Association.

The American Foundrymen's Association some little time ago received a very urgent invitation from the foundrymen of Cincinnati, accompanied by others from the different commercial bodies located in that city, such as the Chamber of Commerce and Young Men's Business League, as well as the mayor of the city, all asking the association to hold its next convention in that city.

The invitation was promptly referred to the executive board, but definite action was delayed because of the effort being also made by Pittsburg to secure the annual meeting of the association for that city.

It would seem, however, that Cincinnati, having their invitation in the hands of the executive board first, gave them an advantage, and it has been favorably acted upon.

The exact date of the meeting has not yet been set, but the reputation for lavish hospitality possessed by the Queen City will doubtless make it a most enjoyable occasion.

The firm of Thomas A. Mack, of Cincinnati, Ohio, who have for some time past been the selling agents for the Sloss Iron and Steel Co., in Ohio and West Virginia, have recently secured additional territory for the sale of "Sloss" pig iron, and now have the exclusive agency for Detroit and the eastern half of Michigan, and also Pittsburg and adjacent territory.

The J. S. McCormick Co., of Pittsburg, Pa., have again exhibited their line of goods at the Pittsburg Exposition, among which may be mentioned molding machines, core making machines, cupola blowers in operation, and a full line of foundry supplies and facings. Among the chief attractions was a bicycle made of foundry supplies. The committee of the Philadelphia Bourse were taken up so much with this novelty that they induced the J. S. McCormick Co. to loan it to them for an indefinite period. Foundrymen, when in Philadelphia, should take the opportunity of seeing this unique bicycle.

We are authorized to state that the report in regard to Rogers, Brown & Co. having leased the property of the Valentine Iron Co. at Bellefonte, Pa., with the intention of operating the plant is not correct.

Who Says a Man Never Masters the Molders' Trade?

Warren Goff has been elected assistant superintendent at the iron foundry after an apprenticeship of two years there. He is said to be an expert workman and to have thoroughly mastered the business.—Milford (Mass.) Gazette.

The foreman, who does the most bossing, does not always get his men to do the biggest day's work.

NOTICE!

Advertisements in this column, 30 cents a line for each insertion. About seven words make a line. The Cash and Copy should be sent to reach us not later than the 20th to insure publication.
Answers addressed to our care will be forwarded.

TO SUBSCRIBERS

whose names appear on our **subscription** list, we will give one free insertion under this heading to those in want of positions, the advertisement to occupy a space of not more than five lines. Additional space or insertions must be paid for in advance at regular rates.

WANTED—Foreman for foundry employing from 40 to 60 men. Must be capable of making his own mixtures and handling men. Address FOUNDRYMEN, Box 101, care FOUNDRY.

WANTED—A first-class foundry foreman, one accustomed to stove plate and light work. State experience and reference. Foundry located in Milwaukee. Address Western, Box 98, care The Foundry.

WANTED—Position by a competent foundry clerk with experience in heavy machinery and architectural trade; sober and well recommended. Address Box 100, care THE FOUNDRY.

A GOOD chance for a Practical Machinist with six to eight hundred dollars capital to locate in Tennessee, 40 miles from any other Foundry or Machine Shop; two Blast Furnaces operated in same town.

FOR SALE—A brass foundry in Brooklyn, N. Y.; brick building, 40x60 feet, lot 60x80; capacity, 2 tons per heat, 2 ton crane. Fully equipped. For further information apply to W. W. BOND, 593 11th st., Brooklyn, N. Y.

AN A1 FOUNDRY FOREMAN desires to make a change. Competent to conduct any part of the foundry business. Best of references. Only those wanting a first-class man should apply to Box 27, care THE FOUNDRY.

BARGAINS IN BLOWERS—We have on hand two No. 6 and one No. 5 second-hand blowers, taken in trade for larger machines; thoroughly overhauled and guaranteed as good as when new. P. H. & F. M. ROOTS CO., Connersville, Ind.

WANTED—A situation as brass foundry foreman. Have had twelve years' experience on both light and heavy castings and can come well recommended as to my ability in mixing metals and handling men. Address Box 97, care The Foundry.

A PRACTICAL foundry manager, with 25 years' practical experience, over 15 years as foreman and manager, desires to establish a foundry supply house, for the sale on commission in New England of foundry appliances from cupolas to snap flasks, supplies from pig iron to core compound, and labor-saving devices. Am ready for business January 1st. Correspondence in all branches of foundry supplies solicited. Address, "Supplies," box 91, care FOUNDRY.

A GENTLEMAN well known to the foundry trade will be at liberty shortly to accept a position as manager or superintendent of a foundry plant. Is a practical mechanic in all that pertains to foundry practice, both in iron and brass, chilled rolls, car wheels, etc., and capable of handling a large number of men with best results; is a thorough business man in buying, selling, making estimates and contracts. For a number of years past has been manager and conducted the entire business of a large foundry plant, and has an extensive acquaintance with railroad officials throughout the west and south; highest references furnished. Address box 93, care THE FOUNDRY.

WANTED—An agreeable associate to join me in purchasing the entire business or controlling interest of a stove manufacturing plant. The writer is in a position to furnish half or three-fourths of capital if necessary. If we buy the entire business we will divide profits, share and share alike. If controlling interest, the intention is to pay small dividends and combine all salaried positions between us, one taking charge of the manufacturing departments, while the other looks after the office work; the writer can fill either position. There is already an established trade in fourteen states, and it is not a question of how many stoves we can sell, but how many we can make. Under existing circumstances the entire capital stock or controlling interest can be purchased at our own price. No mortgage. Clear title. An unparalleled chance is offered an ambitious and energetic partner with from $2,500 to $10,000, capable and willing to do half the work. References exchanged and a full investigation solicited. Address "Practical," Box 103, care THE FOUNDRY.